Chapter 11

INTRODUCTION AND GENERAL REQUIREMENTS

Section 1. Authority. These standards are promulgated pursuant to W. S. 35-11-101 through 35-11-1207. Specifically, W. S. 35-11-302 requires the administrator to establish standards for the issuance of permits for construction, installation, or modification of any public water supply and sewerage system, treatment works, disposal system or other facility capable of causing or contributing to pollution.

Section 2. Purpose. The purpose of these standards is to:

(a) Ensure that the design and construction of sewerage systems, treatment works, disposal systems and other facilities capable of causing or contributing to pollution meet the purpose of the Environmental Quality Act.

(b) Prevent, reduce and eliminate pollution and enhance the waters of the State of Wyoming by ensuring design and construction of systems and facilities are capable of the required treatment and/or disposal and continued operation to protect the health, safety and welfare of the environment and its inhabitants.

These standards pertain only to permits required pursuant to Chapter III and IX, Wyoming Water Quality Rules and Regulations.

Section 3. Intent. The design and construction standards included in these regulations are directed toward conventional wastewater and waste systems. These standards impose limiting values of design for which a construction, installation or modification permit application and plans and specifications can be evaluated by the Division.

The terms “shall” and “must” are used when practice is sufficiently standardized to permit specific delineation of requirements or when safeguarding public health or protection of water quality justifies such definite action. Other terms, such as “should”, “recommend”, and “preferred” indicate desirable procedures or methods which allow devia tions provided the purpose of these regulations can be accomplished.

The applicant shall use the date referenced copy of other standards referred to in these regulations. Where no date is listed for the referenced standards, the standards used shall be those in effect when these regulations become effective.

Section 4. Definitions. The following definitions supplement those contained in W. S. 35-11-103 of the Wyoming Environmental Quality Act.

(a) “Affected land” means the area of land from which overburden is removed, or upon which overburden, development waste rock or refuse is deposited, or both, access roads, haul roads, mineral stockpiles, mill tailings, impoundment basins, and all other lands whose natural state has been or will be disturbed as a result of the operations.

(b) “Campground” means a parcel or tract of land under the control of a person at which sites

are offered for the use of the public or members of an organization either free of charge or for a fee, for the establishment of temporary living quarters for two or more recreational units.

(c) "Commercial/industrial waste and wastewater facilities" means any facility not defined as a municipal or single family residence facility.

(d) "Construction" shall encompass the materials used, installation procedures and tolerances, and testing and disinfection requirements.

(e) "Feedlot" means the concentrated confinement of animals or poultry in pens or houses for meat, milk, or egg production or the stabling of animals or poultry for a period of 45 days or more in a 12 month period when forage or crops are not grown in the area of confinement.

(f) "Hazardous substance" means any matter of any description including petroleum related products and radioac tive material (substance) which, when discharged into any waters of the state, presents an imminent and substantial hazard to public health or welfare. This definition includes all materials (substances) so designated by the U. S. Environmental Protection Agency in the Federal Register for March 13, 1978 (Part III), Water Programs, Hazardous Sub stances.

(g) "Land application/treatment" means the application of wastes or wastewater to the land at a predetermined rate for the purpose of disposal or treatment by any or all of the following processes: degradation, plant uptake, assimilation or accumulation in the soil profile from filtration.

(h) "Maximum daily demand" means the largest daily water use rate which would occur during the calendar year.

(i) "Maximum hourly or peak hourly demand" means the largest water use rate which would occur during any one hour during the year. The maximum hourly demand may or may not occur during the maximum daily demand period.

(j) "Mobile home park" means a parcel or tract of land under the control of a person upon which two (2) or more mobile homes are located on a continual or seasonal nonrecreational basis, regardless of whether a charge is made therefore.

(k) "Off-channel" means the interception of a drainage way which collects runoff only from disturbed areas.

(l) "On-channel" means the interception of a drainage way which collects runoff from both disturbed and undisturbed areas.

(m) "Permanent pool level" means the elevation in a sedimentation pond or sediment control structure below which the water will not be discharged by an outlet structure or by pumping.

(n) "Pond/lagoon" means a manmade or natural basin which is intended for containment, treatment or disposal of wastes or wastewater.

(o) "Rapid infiltration system" means a land treatment system in which treatment is

accomplished by the movement of large quantities of wastewater through a coarse or highly permeable soil profile.

(p) "Recreational unit" means a tent or vehicular type structure, primarily designed as temporary living quarters for recreational, camping, or travel use, which either has its own motive power or is mounted on or drawn by a self-powered vehicle. A tent means a collapsible shelter of canvas or other fabric stretched and sustained by a rigid structure(s) and used for camping outdoors.

(q) "Seasonal high groundwater table" is the highest elevation reached by the groundwater during the wet season of the year (usually spring or early summer).

(r) "Sedimentation control facility" means a pond or structure designed to capture runoff from disturbed areas for the purpose of treating water for sediment and suspended solids removal.

(s) "Slow rate land application system" means an irrigation system in which wastewater treatment is achieved due to vegetative uptake and percolation of wastewater through the soil profile by low application rates.

(t) "Sludge" is the accumulation of solids settled from wastewater in a septic tank, aerobic unit, clarifier, or equivalent.

(u) "Soil" means all unconsolidated material overlaying bedrock.

(v) "Toxic characteristics (or wastes)" means those characteristics (or wastes) which are due to the presence of: substances or combinations of substances including diseasecausing agents which, after discharge and upon exposure, ingestions, inhalation or assimilation into any environmental ly significant organism, either directly from the environment or indirectly by ingestion through food chains, may cause death, disease, behavioral abnormalities, cancer, genetic malfunctions, physiological malfunctions (including malfunc tions in reproduction) or physical deformation in such organisms or their offspring. This definition shall include all substances designated as toxic or hazardous by the U.S. Environmental Protection Agency in the Federal Register for December 24, 1975, (Part IV), Water Programs, National Interim Primary Drinking Water Regulations; Federal Register for May 19, 1980, (Section 261), Hazardous Waste Management System: Identification and Listing of Hazardous Waste; and the Federal Register for July 16, 1982, Part V, National Oil and Hazardous Substances Contingency Plan.

Section 5. Facilities and Systems Not Specifically Covered by These Standards. This section is provided to encourage new technology and equipment and provide a process for evaluating and permitting designs which deviate from these regulations. The proposed construction of facilities and processes not in compliance with these regulations will be permitted provided that the facility, when constructed, can operate meeting the purpose of these regulations.

(a) Each application for a permit to construct a facility under this section shall be evaluated on a case-bycase basis using the best available technology. The follow ing information should be included with the application:

(i) Data obtained from a full scale, comparable installation which demonstrates the acceptability of the design and/or,

(ii) Data obtained from a pilot plant operated under the design condition for a sufficient length of time to demonstrate the acceptability of the design and/or,

(iii) Data obtained from a theoretical evaluation of the design which demonstrates a reasonable probability of the facility meeting the design objectives; and

(iv) An evaluation of the flexibility of making corrective changes to the constructed facility in the event it does not function as planned.

(b) If an applicant wishes to construct a pilot plant to provide the data necessary to show the design will meet the purpose of the act, a permit to construct must be obtained.

Section 6. Engineering Design Report.

(a) Scope and purpose. An engineering design report which describes existing conditions, problems, and the proposed solution is required for each project.

(b) Sewerage systems. The engineering design report shall include:

(i) A description of the service area including scaled vicinity plan map(s) of the project with regard to adjacent and proposed development, elevations, and topograph ic features.

(ii) Current and projected average, maximum day and peak flows for the design of the project, per capita design flows, extraneous flows, and industrial and/or commercial waste flows.

(iii) Downstream impact on existing sewers, lift stations and treatment facilities. This information shall include existing population, waste loads, existing flows and capacity of downstream facilities.

(iv) A letter of acceptance from the municipality, sewer district, or owner of any affected downstream sewerage, treatment or disposal facilities.

(c) Treatment works and disposal systems. The engineering design report shall include:

(i) A description of the facility site and location, including scaled site plan and:

(A) Present and projected facility property.

(B) Flood protection indicating predicted elevation of 25- and 100- year flood stages.

(C) Present and proposed access.

(D) Distances from current habitation.

(E) Prevailing wind direction.

(F) Fencing and/or security.

(G) Topographic features and contours

with indicated datum.

(H) Soil and subsurface geological characteristics. Location of soil borings, rock elevations and groundwater elevations shall be indicated. Provide a soils investigation report of the proposed site.

(ii) A detailed description of the service area for the project including scaled plan showing land use and boundaries.

(iii) A detailed description of the disposal technique for effluent and solids. For lagoons, indicate whether the discharge is continuous, seasonal, or nondischarging.

(iv) Effluent water quality considerations for design of the facility shall be described to include:

(A) Surface discharge. An application shall be submitted to the Water Quality Division for a National Pollution Discharge Elimination System Permit.

(B) Groundwater protection. Pursuant to Chapter VIII of the Water Quality rules.

(v) Design conditions shall be described to include:

(A) Proposed effluent standards.

(B) Design population.

(C) Existing and projected flows and flow variations.

(D) Shock loads, with cause and frequency.

(E) Existing and projected wastewater characteristics including BOD, suspended solids, and pH.

(F) Existing and projected flow, loads and characteristics of industrial wastes and toxic materials.

(G) Existing or proposed quantity and frequency of septage discharges.

(H) Climate conditions at existing or proposed treatment facility site.

(I) Existing or proposed water supply.

(J) Theory of operation.

(K) Odor control features.

(L) Complete description of existing facilities.

(vi) Specific requirements of any pertinent

approved Water Quality Management Plan shall be included.

Section 7. Plans and Specifications Content.

(a) All plans for sewerage works shall have a suitable title showing the following:

(i) Name of owner and location of project.

(ii) North arrow and drawing scale.

(iii) Name and seal or signature of the engineer.

Datum used shall be indicated. Plans shall contain a site plan of the proposed project with topography and boundaries of the project.

(b) Sewers. Plans for interceptor sewers, outfall sewers, new collector systems, force mains, sewer extensions, or any combination shall include:

(i) A detailed plan view at a legible scale of each sewer line showing all existing and proposed streets, adjacent structures, physical features, existing and proposed locations of utilities and a North arrow. The location and size of all sewer lines, manholes, cleanouts, and other appurtenances shall be indicated. Pertinent elevations shall be indicated on all appurtenances.

(ii) Profiles of all sewer lines shall be shown on the same sheet as the plan view at legible horizontal and vertical scales, with a profile of existing and finished surfaces, elevations of the sewer inverts at all manholes, and the slope of the sewer inverts at all manholes, pipe size and material, and the slope of the sewer line. The location of all special features such as inverted siphons, concrete encasements, casing pipes, elevated sewers, etc., shall be shown.

(iii) Special detail drawings, scaled and dimensioned to show the following:

(A) Details of all sewer appurtenances such as manholes, cleanouts, inverted siphons, elevated sewers, encasements, casing pipes, force main thrust blocks, outfall structures, etc.

(B) The approximate bottom of the stream, the approximate elevation of the low- and high-water levels, and other topographic features at all locations where the project is at streams or lakes.

(C) Cross section drawing of the sewer's bedding.

(D) Additional features not otherwise covered by specifications.

(iv) Location of waterlines within 30 feet (9m) horizontally shall be shown on the plan. Water lines that intersect sewers shall be shown on the profile drawings. Public and/or private water wells within 30 feet (9m) of sewer lines shall be indicated on the plans.

(c) Pumping stations, treatment works and disposal systems. Plans shall be submitted showing the relation of the proposed project to the remainder of the system. Layouts and detail plans shall show the

following:

(i) Site location and layout including topographic and physical features, proposed arrangement of pumping or treatment units, existing facilities, existing and proposed piping arrangements, access drive, power supply, fencing, embankments, outfall sewer, outfall structure, and receiving stream with direction of flow.

(ii) Schematic flow diagram(s) and hydraulic profile(s) for treatment works wastewater, sludge and effluent flows.

(iii) Plan and section view(s) of the wetwell and drywell of the pumping station with specific construction details, features and pertinent elevations.

(iv) Plan and section view(s) of each treatment facility process unit with specific construction details, features and pertinent elevations. Details of each unit should include, but are not limited to, inlet and outlet devices, baffles, valves, arrangement of automatic control devices, aeration equipment, motors, sludge scrapers, sludge disposal, electrical devices or other mechanical devices.

(d) Specifications. Technical specifications shall accompany the plans for new sewers, pump stations, treatment works, disposal systems, or additions/modifications to existing systems or facilities. Where plans are for exten sions to sewer systems, the specifications may be omitted, provided it is stated that the work is to be constructed under specifications authorized by the Water Quality Division office. Specifications on file must conform to these regulations.

The specifications accompanying construction drawings shall include:

(i) Identification of construction materials.

(ii) The type, size, strength, operating characteristics, rating or requirements for all mechanical and electrical equipment, including machinery, valves, piping, electrical apparatus, wiring and meters; laboratory fixtures and equipment; operating tools; special appurtenanc es; and chemicals where applicable.

(iii) Construction and installation procedure for materials and equipment.

(iv) Requirements and tests of materials and equipment to meet design standards.

(v) Performance tests for operation of completed works and component units.

PART B

MUNICIPAL AND DOMESTIC SEWERAGE SYSTEMS, TREATMENT WORKS, AND DISPOSAL SYSTEMS

Section 8. General. This part contains the minimum standards for the design and construction of sewerage systems, treatment works, and disposal systems for domestic and municipal wastewater. Soil absorption and land applica tion systems are contained in other parts. All facilities shall comply with the purpose of this chapter.

Section 9. Design of Sewers.

(a) Separate sewers. Separate sewers shall be provided for collection of stormwater and wastewater. Roof, areaway, drive or foundation drains shall not be connected to sanitary sewers.

(b) Pipe materials.

(i) Wastewater characteristics. Pipe materials shall resist acid and alkaline solutions, organic solvents, and other wastewater constituents and environmental condi tions encountered.

(ii) Pipe loadings. Pipe materials shall be chosen and the pipeline shall be designed to withstand all trench and superimposed surface live loads with a minimum factor of safety. Rigid pipes shall have a minimum factor of safety of 1.5, and flexible pipes shall have a minimum factor of safety of 1.25.

(iii) Soil characteristics. Pipe materials shall be chosen to resist corrosion due to aggressive soil charac teristics by the soil it contacts. Iron or steel pipe shall be protected from corrosion with polyethylene encasement or cathodic protection.

(iv) Joints. Pipe joints shall be flexible, durable and designed to minimize infiltration/exfiltration and exclude roots.

(v) Performance tests. Piping shall be subjected to leakage tests. Leakage tests shall be infiltra tion, exfiltration, or air tests.

(A) Infiltration. Maximum of 200 gallons per inch diameter per mile per day (1200 liters/cm/km/day) with a minimum of two feet (0.6 m) of head over the top of the pipe.

(B) Exfiltration. Maximum of 200 gallons per inch diameter per mile per day (1200 liters/cm/km/day) with a minimum of two feet (0.6 m) of head over the top of the pipe.

(C) Air. Air tests shall conform to ASTM C-828-80.

(D) Deflection. Maximum five percent deflection after flexible pipe is backfilled for 30 days. A mandrel of 95 percent of pipe diameter shall be used. No mechanical pulling of mandrel is permitted.

(vi) Approved pipe material specifications. Type of commercial pipe approved for gravity sanitary systems include:

(A) Extra strength and standard strength

vitrified clay pipe: ASTM C700-78a.

(B) PVC sewer pipe and fittings: ASTM D3034-80, SDR35, ASTM F679-81, or ASTM F794-83.

(C) ABS composite sewer pipe: ASTM D2680-80.

(D) Reinforced plastic mortar pipe: ASTM D3262-81.

(E) Asbestos cement nonpressure sewer pipe: ASTM C428-80.

(F) Reinforced concrete sewer pipe: ASTM C76-82.

(G) Concrete Sewer Pipe: ASTM C-14.

(H) Ductile iron sewer pipe: ASTM A746-77.

Types of commercial pipe approved for pressure sanitary sewer systems include:

(I) PVC water pipe: ASTM D2241-80, or AWWA C900.

(J) Asbestos cement pressure pipe: AWWA C400-80.

(K) Ductile iron pipe: AWWA C151-81.

(L) Glass Fiber-Reinforced Thermo-setting-Resin Pressure Pipe: AWWA C950-81.

(c) Collection piping design, construction and testing. A sewage collection line is any conduit that carries wastewater that originates from two or more separate buildings or from a single building that generates more than 2,000 gpd (7.6 mñ/d) of average daily flow.

(i) Gravity system.

(A) Depth. Sewers shall be located to protect them from freezing and frost heave as prudently possible.

(B) Size. Sewers to be aligned straight shall be eight inch (20.3 cm) diameter or larger except six inch (15.2 cm) sewers may be used in cul-de-sacs, or other dead end locations where the sewer cannot be extended in the future. Eighteen-inch (45.7 cm) or larger sewers may be laid on curves. Lines shall be sized for 200 percent of maximum daily flow or more. In the absence of data deriving maximum daily flow, the chart on Figure 1-1 shall be used to deter mine maximum daily flow.

(C) Slope. Sewers shall be laid with uniform slope between manholes. Minimum slopes shall be:

Sewer Size	Minimum Slope in Feet

Inch (cm)	Per 100 Feet (m/100 m)
6 (15.2)	0.60
8 (20.3)	0.40
10 (25.4)	0.28
12 (30.5)	0.22
14 (35.6)	0.17
15 (38.1)	0.15
16 (40.6)	0.14
18 (45.7)	0.12
20 (50.8)	0.11
21 (53.3)	0.10
24 (61.0)	0.08
27 (68.6)	0.067
30 (76.2)	0.058
33 (83.8)	0.051
36 (91.4)	0.046

Maximum slopes without the use of concrete anchors shall be 20 percent. The following spacing of concrete anchors shall apply to slopes greater than 20 percent:

Slopes (percent)	Concrete Anchor Spacing
20-35	36 ft (11 m)
35-50	24 ft (7.3 m)
More than 50	16 ft (4.9 m)

(D) Velocity. Minimum velocities shall be 2 fps (0.6 mps) when flowing full. Velocities greater than 10 fps (3.0 mps) require special design considerations.

(E) Increasing size. All sewer pipe size changes shall be at manholes. Pipe size shall not be decreased in the direction of flow. The energy gradient line should be maintained when a smaller sewer joins a larger one.

(F) Excavation, bedding installation, backfill.

(I) Excavation. Trench width from the trench bottom to a point one foot above the top of the pipe shall be no less than the outside diameter of the pipe plus 8 inches (20.3 cm) but not more than 24 inches (61 cm) plus the pipe O.D. The trench bottom shall be excavated for the pipe bell. All rock shall be removed within six inches (15.2 cm) of pipe. The trench shall be dewatered for all work.

(II) Bedding. Bedding shall be designed in accordance with:

(1.) Rigid pipe. Types A, B, C (Water Pollution Control Federation Manual of Practice No. 9) or ASTM C12-81.

(2.) Flexible pipe. Types I, II, III, ASTM D2321-74.

(III) Backfill. Backfill shall be performed without disturbing pipe alignment. Backfill shall not contain debris, frozen material, unstable material, or large clods. Stones greater than three inches (7.6 cm) in diameter shall not be placed within two feet (0.6 m) of pipe. Compaction shall be to a density equal to or greater than the surrounding soil.

(ii) Force mains and pressure sewers.

(A) Depth. Force mains shall be located to protect them from freezing and frost heave.

(B) Size. Force mains shall be four inches (10 cm) diameter or greater. Pressure sewer collec tion system piping shall be one inch (2.4 cm) minimum.

(C) Velocity. Minimum velocity shall be 2.5 fps (0.76 mps).

(D) Air release. Air release facilities shall be provided at the high point in the piping whenever the pipe crown elevation falls below the pipe invert eleva tion. Access to air release manholes shall not be in traffic-ways.

(E) Cleanouts. Cleanouts shall be provided at 400 foot (122 m) maximum spacing in pressure piping four-inch diameter or less.

(F) Pressure sewer systems. Pressure sewer collection systems shall be preceded by grinder pumps or septic tanks.

(G) Pressure sewer collection system pumps. Pumps shall be provided with isolation and check valves. If a septic tank is not provided before the pump, a grinder pump shall be required. Pump holding sumps shall not be steel, iron, or coated metal. The sump chamber shall be 50 gallon (189 liters) volume, minimum.

(iii) Service connections. A service connection is any conduit that carries wastewater that is not defined as a sewage collection line. Service connections shall conform to the requirements for sewage collection lines (Section 9(c)(i) and (ii)) with the following modifications:

(A) Size: minimum size shall be four inches (10.2 cm).

(B) Slope: minimum slope shall be two feet/100 feet (2 m/100 m).

(C) Flow: flow shall be determined from a fixture unit count and the sewage size based on flowing full.

(D) Connections: all service connections to sewage collection lines shall be made with a wye or tee for new construction and a tapping saddle for connection to existing collection lines.

(d) Manholes and cleanouts.

(i) Location. Manholes shall be located at all changes in pipe size, vertical or horizontal alignment, pipe intersections, and the end of lines. Maximum spacing for various line sizes are as follows:

Line Size (In)	(cm)	Maximum M.H. Spacing	
15 or less	(38 or less)	400 ft	122 m
16 - 30	(40.6 - 76)	500 ft	152 m
31 or more	(76 or more)	600 ft	183 m

Terminal sewer cleanouts may be provided at the end of sewer lines if they are not more than 150 feet (45 m) from the nearest downstream manhole. The cleanout shall be constructed using 45 degree bends to the upturned pipe coming to the surface of the ground. The diameter of the cleanout shall be the same as the pipe size. Lampholes shall not be used.

(ii) Size. Minimum manhole interior size is four feet (1.2 m).

(iii) Drop manhole. Drop manholes must be constructed where the change in elevation between two lines is greater than 24 inches (0.6 m). Concrete encasement shall be provided around the drop pipe.

(iv) Invert. Manhole inverts shall be constructed to conform to the shape of the sewer. The bench shall drain to the invert. Connections to the manhole shall be watertight and allow differential settlement between the manhole and pipe. Minimum fillet height shall be one-half of the pipe diameter.

(v) Cover. The manhole cover shall be suitable to withstand all loads, including impact loading without deformation, slip or rattle. The manhole cover shall be watertight in areas subject to flooding and a bolt-down type in areas subject to unauthorized dumping or vandals.

(vi) Steps. Access to manholes shall be with portable ladders, or with cast iron manhole steps spaced at 16 inches (40.6 cm) maximum.

(vii) Materials. Manholes shall be constructed watertight and durable using cast-in-place concrete, or precast concrete with gasketed joints. Where precast concrete bases are used, the first 12 inches (30 cm) of wall will be monolithically cast with the base.

(viii) Access. A 22 inch (56 cm) minimum diameter clear opening shall be provided on all manholes. All manholes shall be located to be accessible by motorized equipment for maintenance.

(e) Special structures.

(i) Inverted siphons. Inverted siphons shall have a minimum of two six-inch (15.2 cm) barrels. The inlet and outlet shall be arranged to cause only one pipe to be used during normal flows. The minimum velocity shall be 3 fps (1 mps) at average flow, and occur at least daily. The siphon shall be designed for flushing and maintenance.

(ii) Aerial crossings. Aerial crossings shall be designed to prevent freezing, leaking, settlement, lateral movement, and damage from expansion/contraction. It shall be located with proper vertical clearances for highway vehicles and the 100 year flood.

(iii) Stream crossings. Stream crossings shall be within 10@ of the perpendicular direction of the stream. Pipe shall have a minimum cover of one foot in rock, and three feet under other surfaces. The crossing shall be made with an inverted siphon or without a grade change. Pipe materials shall be steel, cast iron, or ductile iron pipe.

(f) Potable water supply protection.

(i) Cross connections. There shall be no cross connections between sewer lines and potable water lines.

(ii) Horizontal and vertical separation from water mains. Minimum horizontal separation shall be ten feet (3 m) where the water main is less than 1.5 feet (0.46 m) above the elevation of the sewer. Minimum vertical separa tion shall be 1.5 feet (0.46 m) at crossing. Joints in sewers at crossing shall be located at least ten feet (3 m) from water mains. The upper line of a crossing shall be specially supported. Where vertical and/or horizontal clearances cannot be maintained, the sewer shall be placed in a separate conduit pipe.

Section 10. Pumping stations.

(a) Design conditions.

(i) Total dynamic head. The total dynamic head rating of pumping units shall be based on pipe friction, pressure losses from piping entrances, exits, appurtenances (bends, valves, etc.), and static head at the rated flow.

(ii) Grit. Where no grit removal is provided ahead of the pumping station, equipment and piping design shall minimize the deleterious effects of grit in the sewage.

(iii) Screening. Screens or comminutors shall be provided ahead of pumps where the average daily flow is in excess of 1.0 mgd (3,784 mñ/d) to prevent solids larger than 2 1/2 inches (6.4 cm) from entering the pump.

(iv) Minimum pump opening. Except for grinder pumps, raw sewage pumps shall be capable of passing spheres of at least three inches (7.6 cm) in diameter. Pump suction and discharge piping in all sewage and sludge services shall be no smaller than four inches in diameter (10 cm).

(v) Pump cycle time. Intermittently operated pumps shall be designed to start no more often than once every ten minutes at the minimum operating interval.

(vi) Removal of equipment. Pumping stations shall be designed to permit removal of all items of equipment including pumps, valves, electrical and control equipment. Equipment located in wetwells shall be removable without entering the wetwell.

(vii) Surge control. Piping systems shall be designed to withstand the maximum possible surge (water hammer) from the pumping station, or adequate surge control provided to protect the piping. Pressure relief valves are not acceptable surge control.

(viii) Net positive suction head. Pumps shall be selected so that the net positive suction head required at maximum flow (NPSHR) is less than the NPSH available minus four feet (1.2 m) based on the hydraulic conditions and altitude of the pumping station.

(ix) Uplift. The pumping station chambers shall resist hydrostatic uplift pressures.

(b) Siting requirements.

(i) Access. Pumping stations shall be located so that they are readily accessible to operating and mainte nance personnel at all times of day or night, and under all weather conditions. Pumping stations shall be located off of traffic ways.

(ii) Flood protection. Pumping stations shall be designed so there is no equipment or structural damage in the 100 year flood, and so the pumping station's operation is uninterrupted by the 25 year flood.

(iii) Security. The pumping station shall be designed to discourage unauthorized entry.

(c) Pumping station types.

(i) Dry wells.

(A) Access. Pumping station dry wells and equipment rooms shall be accessible for equipment inspection, operation and maintenance. Ladder and stair dimensions, locations of landings, and structural design shall comply with the Wyoming OHSA (1982). Equipment shall be removable from pumping stations without making structural changes to the station.

(B) Separation from wetwell. Dry wells and equipment rooms shall be completely separated from wetwells with no hatches, untrapped drains, or other connecting accessways.

(C) Dewatering. Dry pits and below-grade equipment rooms shall be provided with sump pumps sized to remove infiltration of water during normal seepage and leakage.

(ii) Wetwell design. Wetwells shall be designed to prevent vortexing and unstable pump operation. Pumps
shall be located below the minimum water level, except suction lift pumps. Suction intakes shall be bell-mouthed. Provi sions shall be made for isolating, bypassing and/or dewatering portions of the wetwell for maintenance. Hopper walls of wetwells shall be sloped at no less than 1.75 vertical to 1 horizontal.

(iii) Submersible pumping stations. Submersible pumping stations shall be designed

specifically for totally submerged operation and so that pumps may be readily removed from the wetwell without dewatering the wetwell or discon necting piping in the wetwell. Submersible pumps shall have an adequate means of indicating motor seal failure. Electri cal equipment shall be suitable for Class 1, Division 1, Groups C and D hazardous environments, as defined in the National Electrical Code (1982).

(iv) Suction lift. Pumping stations utilizing suction lift pumps shall have adequate priming means to prime the pumps quickly and shall be designed for priming the pumps when the water level in the wetwell is one foot (0.3 m) below the lead pump starting elevation in the suction wetwell, and for maintaining prime when the wetwell level is one foot (0.3 m) below the lead pump stopping level. Valving shall not be located in the wetwell.

(v) Pneumatic ejectors. Pneumatic ejectors shall be limited to design flows equivalent to 25 residential connections. One standby compressor shall be provided.

(vi) Grinder pumps. Grinder pumps shall be limited to design flows equivalent to 25 residential connec tions.

(d) Piping and valves.

(i) Suction.

(A) Suction intake. Suctions shall be located so the pump is below the minimum water level. Suction intakes shall be bell-mouthed. Suction intakes shall be located against the far wall from the wetwell inlet.

(ii) Piping.

(A) Size. Sewage and sludge piping shall be no smaller than four inches (10.2 cm) diameter, except as required for metering, or where grinder pumps are provided.

(B) Velocity. Piping and pumping systems shall be designed to maintain a minimum velocity of 2.5 fps (0.76 mps), and a maximum velocity of 5 fps (1.52 mps) for suction piping.

(C) Design pressure. Piping shall be designed for the maximum operating pressure and for the maximum value of any surges (water hammer) which may occur, taking into account any surge protection provided.

(D) Restraints. Piping shall be blocked and otherwise restrained to prevent damaging movement under the maximum anticipated pressure (including test pressure).

(E) Cleanouts. Cleanouts shall be provided in pump suctions.

(iii) Valves. Valves shall not be located in wetwells.

(A) Shutoff. Except on submersible pumps and suction lift pumps, a shutoff

valve shall be provided on the suction of all pumps. A shutoff valve shall be provided on the discharge of all pumps, regardless of type or service.

(B) Check. All pumps shall be provided with a check valve located between the pump and the discharge shutoff valve, except where arranged so that backflow is not possible under normal operating conditions.

(C) Air release. Air release valves shall be provided at the high points in piping whenever the pipe crown elevation falls below the pipe invert elevation. On sewage lines, air or air and vacuum release valves shall be specifically designed for sewage service.

(e) Reliability.

(i) Multiple units. Every pumping station shall have not less than two pumping units. The number of units and their size shall be sufficient to permit pumping the maximum design flow with the largest pumping unit out of service.

(ii) One of the following shall be provided:

(A) Alternative power source. Where the pumping station serves more than 50 residential units, alternative power shall be provided. Alternative power shall be permanently installed or portable engine generator sets, permanently installed or portable engine driven pumps or a separate, independent utility source provided. Where manual starting is required, sufficient storage shall be provided to allow notifying the operator and performing whatever tasks are necessary to get the pumping station in service. Where permanently installed engine driven equipment is provided, sufficient fuel shall be provided for at least eight hours operation under the maximum flow condition. Where more than one pumping station is affected by a power outage and portable equipment is planned for alternative power source, sufficient portable equipment shall be provided to provide alternative power to all pumping stations under maximum flow conditions.

(B) Generators. Generators shall be sized to permit starting the largest pump in the pumping station with all other pumps except one running. If the generator is not capable of starting all pumps simultaneous ly, suitable controls shall be provided to stagger the pump starts to remain within the capabilities of the equipment. Generators shall be diesel-fired, natural gas-fired or bottled gas-fired. The use of gasoline or digester gas-fired generators for permanently installed standby service is unacceptable. Gasoline-fired portable generators are accept able.

(C) Engine driving pumps. Engine driven pumps shall be sized for maximum design flow. Diesel, natural gas and bottled gas are acceptable fuels for portable engines only. Digester gas is unacceptable for standby fuel. Quick connecting couplings shall be provided for portable engine driven pumps.

(D) Storage. Wastewater storage may be provided in the form of underground storage or surface ponds or tanks in lieu of alternative power supplies. Storage shall be sized for the maximum anticipated power outage, but not less than 24 hours at average design flow. Storage shall be water tight and arranged to drain back to the pumping station wetwell.

(f) Electrical.

(i) Equipment location. All electrical equipment, including motors, motor starters and controls shall be located so as to be undamaged by the 100 year flood.

(ii) Controls. Controls shall include a separate start/stop device for each pump or for each pumping position in the control sequence. Controls shall be arranged so that the failure of any one control system component will affect only the operation of one pumping unit. Manual override shall be provided for normal pump operating control.

(iii) Code requirements. All electrical work shall comply with the National Electrical Code as adopted and amended by the Wyoming Department of Fire Prevention and Electrical Safety. Electrical equipment in enclosed wetwells which may be subject to explosive concentration of hazardous gases or flammable fluids, including all raw sewage wetwells, shall comply with the NEC requirements for Class 1, Division 1, Groups C and D areas.

(iv) Alarms. An alarm system shall be provided for each pumping station. As a minimum, alarms shall include high wetwell level and high water level in the dry well. For pumping stations having a capacity of 0.5 mgd (1890 mñ/d) or more, the alarm shall be telemetered to a facility that is manned 24 hours a day. For pumping stations having a capacity of 0.5 mgd (1890 mñ/d) or less, an audio and visual alarm shall be provided in a conspicuous location.

(g) Safety.

(i) Ventilation. All accessible pumping station areas shall be ventilated. Ventilation may be continuous or intermittent. If intermittent, ventilation in areas normally visited by operating personnel shall be started automatically at not greater than 30 minute inter vals. permanently installed dry well ventilation shall provide at least six air changes per hour if continuous, and 12 air changes per hour if intermittent. Permanently installed wetwell ventilation shall provide 12 complete air changes per hour if continuous, and 30 complete air changes per hour if intermittent. Wetwell ventilation shall be positive pressure, forcing air into the wetwell rather than exhaustion from it. All ventilation equipment shall be of a non-sparking design. Intermittent ventilating equipment shall insure starting upon entry of operating personnel. Wetwells may be ventilated by gravity means if normal access by operating personnel is unnecessary. Wetwells that are accessed infrequently shall be designed to permit the use of portable blowers that will exhaust the space and continue to supply fresh air during access periods.

(ii) Hoists. Where required for removing equipment, hoists shall be rated for not less than 50 percent more than the weight of the heaviest single item to be lifted by the hoist.

(iii) Lighting. Lighting levels shall be sufficient to permit safe operation and maintenance of all equipment within the pumping station, but not less than 30 foot-candles. All areas shall be lit in such a manner that the failure of one lighting fixture or lamp will not cause the area to be completely dark.

(iv) Equipment guards. Provide shields to protect from rotating or moving machinery.

(v) Warning signs. Provide warning signs for nonpotable water, electrical hazards, chemical hazards, or other unsafe features. Warning signs shall be permanently attached to the structure or appropriate equipment.

(vi) Safety. Comply with the Wyoming Occupational Health and Safety Rules and Regulations.

Section 11. General Treatment Plant Considerations.

(a) Surface water protection. Discharges to surface waters shall meet or exceed quality limitations in the National Pollution Discharge Elimination System Permit. Plant configurations and piping shall be arranged to avoid the bypassing of process units that could result in inade quately treated sewage reaching the receiving surface water.

(b) Groundwater protection. Seepage and/or discharge to groundwater shall comply with Chapter VIII of the Water Quality Regulations. Plan configurations and piping shall be arranged to avoid the bypassing of process units that could result in inadequately treated sewage reaching the groundwa ter.

(c) Siting requirements.

(i) Isolation. Treatment facilities shall be located to minimize public and private nuisances and health hazards on inhabited areas or residential areas. Where treatment plant siting does potentially affect inhabited areas, appropriate measures to minimize nuisances or hazards shall be incorporated in the design.

(ii) Flood protection. All treatment process structures, mechanical equipment, and electrical equipment shall be protected from the 100 year flood. The treatment facilities shall remain fully operational and accessible during the 25 year flood.

(d) Hydraulic and treatment reliability.

(i) Alternative power source. All treatment plants shall have an alternative source of power to provide reliable pumping and disinfection of sewage if required. The alternative source of power shall be sized to provide the capability to pump design maximum day flow rates through the treatment process and to disinfect the sewage if necessary. Acceptable alternative power sources include:

(A) A diesel, natural gas, or propane fueled engine generator.

(B) A second independent electrical supply.

(C) Storage of sewage and subsequent treatment.

(ii) Bypass treatment units. Complete by-passing of treatment units is prohibited. Provide means to bypass any duplicate process unit or single unit where adequate downstream process capability is provided. Sewage shall be treated in parallel singular units and/or subsequent processes.

(iii) Multiple units. For average design flows greater than 100,000 gpd (378 m3/d), more than one unit of each unit process shall be provided. For average design flows of less than 100,000 gpd (378 m3/d), one unit of each unit process may be provided if electrical or mechanical equipment or diffusers can be removed while the unit is in operation, or if the unit can be compartmentalized to permit access. There shall be no provision to bypass the entire plant nor shall bypass provisions be made that will allow inadequately treated sewage to reach the ground or surface waters.

Where more than one parallel unit is provided, positive means of dividing the flow proportionally between units shall be included (such as splitter weirs or valves and meters).

(iv) Multiple equipment. Mechanical process equipment shall be provided in multiple units. All pumping functions shall include sufficient pumping capacity that the peak flow can be pumped with the largest single unit not in service. Blowers and mechanical aerators for process aeration shall include sufficient capacity that the maximum day design capacity can be delivered with the largest single unit not in service. Other equipment shall have standby units where their function is critical to the treatment process.

(e) Electrical.

(i) Equipment location. Service transformers and other critical electrical equipment shall be located above the 100 year flood and above grade. Transformers shall be located in a manner that they are remote from or protected by substantial barriers from traffic. Motor controls shall be located in superstructures and in rooms that do not contain sewage, chemical processes, or corrosive atmospheres.

(ii) Code requirements. All electrical work shall comply with the National Electrical Code as enacted and amended by the Wyoming Department of Fire Prevention and Electrical Safety. Areas in which the occurrence of explo sive concentrations of hazardous gases or flammable fluids can occur Class 1, groups C and D, Division 1 locations shall be designed for hazardous locations in accordance with the National Electrical Code.

(f) Structural.

(i) Construction materials. Construction materials shall be selected, apportioned, and/or protected to provide water tightness, corrosion protection, and resistance to weather variations.

(ii) Coatings. Coatings used to protect structures, equipment and piping shall be suitable for atmospheres containing hydrogen sulfide and volatile organics. Surfaces exposed in chemical areas shall be protected from chemical attack. Concrete surfaces in confined spaces containing sewage shall be protected. Paints containing lead or mercury shall not be used.

(iii) Geological conditions. Structural design shall consider the seismic zone, groundwater and soil support. Soils investigations shall be made, or adequate previous soils investigations shall be available to develop structural design.

(g) Safety. The Wyoming Occupational Health and Safety Rules and Regulations shall be complied with. The following items shall also be provided:

(i) Instruction manuals. Instruction manuals shall be provided for all mechanical and electrical equipment describing operation, maintenance, and safety.

(ii) Handrails. In addition to all Wyoming OSHA requirements, barriers around treatment basins shall be provided.

(iii) Warning Signs. Provide warning signs for nonpotable water, electrical hazards, chemical hazards, or other unsafe features. Warning signs shall be permanently attached to the structure or appropriate equipment.

(iv) Equipment guards. Provide shields to protect from rotating or moving machinery.

(v) Lighting. Provisions shall be made to light walkways, paths, and other accessways around basins, in buildings and on the site. All areas shall be lit in a manner that the failure of one lighting fixture will not cause an area to be dark, or the loss of power will not cause a room or enclosed area to be dark.

(vi) Climate conditions. Design of facilities such as exposed stairs, walkways, and sidewalks shall include nonskid surfaces.

(h) Instrumentation.

(i) Location. A flow measuring device shall be provided for the plant effluent unless it is a mechanical plant where an influent flow measuring device will be acceptable.

(ii) Type. For plants having an average design flow of 50,000 gpd (189 m3/d) or more, the flow measuring device shall provide recording of instantaneous flow rate, enable calculation of average daily flow rate and have provisions for calibration and correction.

(iii) Controls. Automatic controls shall be designed to permit manual override.

(iv) Alarms. Conditions that may affect discharge quality or personnel or public safety shall be alarmed at an attended location.

(i) Sampling. Access shall be provided to sample untreated wastewater ahead of the treatment facilities prior to adding any process return flows, and sampling of the effluent after all treatment process units, but before discharge to the receiving stream. An automatic sampler that composites samples in proportion to the flow rate on the effluent shall be provided if required by the NPDES permit.

(j) Ventilation. All enclosed spaces shall be provided with forced ventilation, excepting pumping station wetwells, scum pits, anaerobic process units, and man-holes. In areas where there are open sewage channels, wet pits exposed to the room or process units without gas tight enclosures,

ventilation shall be provided to maintain a higher pressure in the room than atmospheric and shall provide 12 air changes per hour. In equipment rooms, ventilation shall be provided to limit the temperature rise in the room to less than 15@ F (8@ C) above ambient, but not less than six air changes per hour. Rooms housing chlorine storage and/or feeders shall have provisions for exhausting the room contents in two minutes and continuous ventilation to provide 12 air changes per hour.

(k) Dewatering of treatment units. All treatment units, channels, housing screens, or other embedded equip ment, and wetwells shall be provided with drains or sumps that facilitate draining the unit for access and maintenance.
Drainage shall be to upstream process units. Basin slabs shall be designed to successfully resist the hydrostatic uplift pressure or relief valves shall be provided.

(l) Cold weather protection. All equipment including pumps, bar screens, grit washers, electrical equipment and other equipment not required to be in or on open basins (such as clarifier drives and surface aerators) shall be housed in heated, lighted, and ventilated structures. Structure entrances shall be above grade. Piping shall be buried below frost level, placed in heated structures, or provided with heat and insulated. Walkways shall be located away from areas of spray and/or ice buildup.

(m) Chemical storage. All chemical storage shall be housed or buried. Areas designated for storage of specific chemicals shall be separated from areas designated for other reactive chemicals. Liquid storage containers shall be isolated from other portions of the structure by a curb that will contain and/or drain ruptured tank contents. Concrete floors, walls and curbs in chemical storage and feed areas shall be coated to protect the concrete from aggressive chemicals. Floors in polymer feed and storage areas shall be provided with nonslip surfaces. Rooms for chlorine storage and feed equipment shall be gas tight and be provided with entry from outdoors. All toxic chemical storage areas shall be provided with lighting and ventilation that are switched from outside the room, and windows to permit viewing the room from outside.

(n) Design capacities.

(i) Flow. In the absence of flow measurement information, the design average daily flow shall be based on a per capita daily flow rate of 100 gallons (378 liters). Allowances shall be made for return flows from digesters, sludge thickeners and the like, and the infiltration and wet weather inflow into older sewer systems. Significant industrial waste flows shall be added to the per capita flow rate.

(ii) Organic loads. In the absence of wastewater strength data, domestic waste treatment design shall be based on a per capita daily BOD and suspended solids contri bution of 0.22 lb (0.10 kg) and 0.25 lb (0.11 kg), respec tively. The influence of sidestream return flows and significantly strong industrial wastes shall be considered and included in the design where applicable.

Section 12. Pretreatment.

(a) Flow equalization.

(i) Storage requirements. Where mechanical plants experience large diurnal varia-

tions in flow rate which will cause mechanical, hydraulic, or biological process upsets, flow equalization shall be provided.

(ii) Location. Pretreatment facilities, such as bar screens, comminutors and grit chambers, and where possible, primary clarifiers should be located ahead of the equalization basin.

(iii) Drainage and cleaning. Provisions shall be made to isolate, drain and clean the basin(s).

(iv) Aeration and mixing. Aeration shall be sufficient to maintain a minimum of 2.0 mg/L of dissolved oxygen in the basin at all times. Air supply rates shall be a minimum of 10 cfm/ 1,000 cubic feet (10 m3/min/1000 mñ) of volume for primary treated wastewater and 20 cfm/1,000 cubic feet (20 m3/min/1000 m3) of volume for raw or screened waste water.

(v) Controls. Controls shall be provided to control the flow rate from the flow equalization basin. Flow measurement devices shall be provided.

(b) Screens.

(i) Location. Coarse screens shall be the first unit in the treatment process. Screens shall be housed. The housing shall be heated and ventilated. Access shall be separated from other enclosed spaces. Housing shall be designed for hazardous location (National Electrical Code, Class 1, Groups C and D, Division 1 locations).

(ii) Capacity. The screen capacity shall be capable of handling the maximum anticipated peak hourly flow including inflow and infiltration.

(iii) Types.

(A) Mechanically cleaned. Bar screens shall be mechanically cleaned if the removal of the daily accumulation of screenings results in surging of the flow. Manually cleaned screens shall be provided in parallel channels to permit removal of the mechanically cleaned screen from service. Bars shall be between 45@ and 90@ measured from the horizontal.

(B) Manually cleaned. Manually cleaned bar screens shall be used for bypass of a mechanically cleaned screen or for treatment installations having an average design capacity of less than 100,000 gpd (378 mñ/day). Bars shall be between 30@ to 45@ from the vertical.

(iv) Bar spacing. Clear spacing on mechanically cleaned bar screens shall range from 1/2 inch to 1 3/4 inches (1.27 cm to 4.45 cm). Manually cleaned screens shall have a range from one to 1 3/4 inches (2.54 cm to 4.45 cm) clear spacing. Coarse screens may have spacing greater than 1 3/4 inches (4.45 cm).

(v) Velocities. Maximum approach velocity at average flows for a mechanically cleaned screen shall be 3.0 fps (0.91 mps). Maximum velocity for a manually cleaned bar screen shall be 1.5 fps (0.46 mps). Minimum velocities shall be1.25 fps (0.38 mps).

(vi) Channel. Channels shall be designed to eliminate deposition and permit draining.

The channel shall contain a rock trap ahead of mechanically cleaned screens. Multiple channels shall be designed to allow uniform and equal flow to the screens. Slide gates shall be provided to permit isolating sections of channel containing screens.

(vii) Controls. Cleaning operation shall be controlled by one or several of the following methods.

(A) Timers. A timer to start the cleaning operation, and a device to stop the cleaning operation after one cycle.

(B) Differential head. Cleaning device starts and stops on differential head across screen.

(C) High level switch. Cleaning device starts on high level and runs for predetermined length of time.

All screens shall have manual override capability. All controls shall be suitable for use in hazardous location (National Electrical Code, Class 1, Groups C and D, Division 1 locations).

(viii) Handling. Screenings receptacles shall be designed to contain a minimum of one day's screenings. Manually cleaned bar screens shall include an easily accessi ble and safe working platform. All handling areas should be well drained.

(ix) Disposal. Screenings shall be disposed of in a manner approved by the Department of Environmental Quality, Solid Waste Management section. Grinding of screenings and return to the wastewater flow is not accept able.

(c) Comminutors.

(i) Location. When used, comminutors shall be located downstream of a coarse screen. Where grit removal is provided, comminutors shall be located downstream.

(ii) Capacity. Comminution or screening capacity shall be adequate with the largest comminutor out of service.

(iii) Number of units. Wherever comminutors are used, a bypass, manually cleaned bar screen shall be in stalled.

(iv) Channel. Provide stop plates or similar devices to permit isolating a comminutor for maintenance. Provide drainage and washdown facilities. Where grit removal is not provided upstream, provide a gravel trap upstream of each comminutor.

(v) Bypass. An emergency bypass with a manually cleaned bar screen shall be provided. All flow exceeding the operating capacity of the comminutor(s) shall be automatically directed to the emergency bypass.

(vi) Controls. The comminutor shall run continuously. All electrical controls shall be

NEC Class 1, Groups C and D, Division 1 rated.

(d) Grit removal and disposal.

(i) Where required. Grit removal shall be provided either by providing for its accumulation in other process units or by removal in a specially designed basin. Where accumulation is provided in other process units, duplicate units shall be provided to permit removal of grit.

(ii) Location. Grit removal shall be placed after bar screens or racks, but before comminutors and other treatment units. Where grit removal facilities can be located at grade, they shall be upstream of raw sewage pumping stations. Grit basins may be located outdoors with proper precautions against freezing, but all grit conveying, washing and handling facilities shall be located indoors.

(iii) Capacity. Grit removal devices shall be designed to effectively remove grit at the peak instantaneous flow rate. The grit handling capacity shall be a minimum of 15 cubic feet per million gallons (1.12 mñ/10,000 mñ).

(iv) Number of units. A minimum of one mechanically cleaned unit and a bypass pipe or channel shall be provided for plants serving separate sewers. Five hundred thousand gallons per day (500,000 gpd) (1891.5 mñ/d) plants or smaller may have a manually cleaned unit and bypass. Plants larger than 1.0 mgd (3784 mñ/d), shall have two mechanically cleaned units with capability to isolate each one.

(v) Type.

(A) Aerated.

(I) Air requirements. Air supply must be controllable and capable of varying from 10 to 40 cfm/1,000 cubic feet (10 to 40 mñ/m/1,000 mñ) of basin. Air diffusers shall be located above the tank bottom and posi tioned for adequate mixing.

(II) Equipment requirements. The tank shall be sized for a three minute retention time at peak flows. Grit shall be collected to a hopper for removal by 60 or greater sloped sides or mechanical equipment. The inlet and outlet shall be designed to avoid shortcircuiting. Air diffusers shall be removable without taking the basin out of service.

(B) Gravity chamber. Horizontal channel grit basins shall have an outlet control weir and specially shaped channel to maintain velocities from 0.8 to 1.3 fps (0.24 to 0.4 m/s) over the anticipated range of flows. Square basins shall be designed for an overflow rate of 30,000 gpd/sq ft (1220 m /m /d) at the peak instantaneous flow rate.

(vi) Method of grit removal. Grit removal facilities located in pits six feet (1.8 m) or deeper and for plants larger than 500,000 gpd (1891.5 mñ/d) shall be provided with mechanical equipment for moving grit to ground level.

Plants having an average design capacity less than 100,000 gpd (378 mñ/d) may be provided with manually cleaned grit basins.

(vii) Drains. Each unit in the grit facility shall be capable of being dewatered.

(viii) Grit disposal. Grit disposal methods shall be approved by the Department of Environmental Quality, Solid Waste Management Office.

Section 13. Primary Treatment.

(a) Sedimentation.

(i) Number of basins. For plants having an average design capacity greater than 100,000 gpd (378.4 mñ/d) and where primary settling is provided, multiple units capable of independent operation shall be provided.

(ii) Design parameters.

(A) Performance. Unless full-scale data is available, primary settling shall be assumed to remove one third of the influent BOD and 55 percent of the influent suspended solids. It is unacceptable to return waste activated sludge to the primary clarifier.

(B) Water depth. The minimum side water depth shall be seven feet (2.1 m).

(C) Surface overflow rates. Surface overflow rates shall not exceed 1,000 gpd/sq ft (41 mñ/m²d) of surface area at the average design flow nor 1,500 gpd/sq ft (61 mñ/m²d) of surface area at the maximum day flow rate. Maximum day flow is the highest flow over a 24 hour period that is projected to occur during the design year.

(D) Weir loading rates. Circular basins (or basins with center inlets) shall be provided with a full periphery weir. Rectangular basins shall be provided with end weirs that provide less than 80,000 gpd/ft (9,920 mñ/m? d) weir hydraulic loading at peak instantaneous flow rates.

(iii) Clarifier inlet and outlet.

(A) General. Clarifier inlet structures shall be designed to achieve the following:

(I) Dissipate the inlet kinetic energy.

(II) Distribute the flow evenly into the tank.

(III) Prevent short circuiting.

Inlet channels or piping shall be designed for minimum velocities of one fps (0.3 mps). Where minimum velocities are less, mixing, flushing or other means of resuspending solids shall be provided.

Circular basins shall be provided with symmetrical baffling to distribute flow equally in all radial directions.

Rectangular basins shall be provided with inlet parts uniformly distributed along the entire end of the basin and shall be provided with baffles.

(B) Weirs. Weir plates shall be adjustable for leveling and sealed against the effluent channel.

(C) Baffles. Provide scum baffles at the water surface to intercept all floating materials and scum prior to the weir. Baffles should extend three inches (7.6 cm) above the weir plate elevation and eight inches (20.3 cm) below the water surface.

(D) Clarifier effluent channel.

(I) Size. The effluent channel shall be sized to prevent weir submergence at the peak hourly flow.

(E) Freeboard. The outer walls of sedimentation tanks shall extend at least six inches (0.15 m) above the surrounding ground and shall provide at least 12 inches (0.3 m) of freeboard to the water surface. Where basin walls do not extend four feet (1.2 m) above the surrounding ground, a fence or suitable barrier to prevent debris from entering the basin shall be provided.

(F) Basin equipment and access. Provide walkways and accessways to collector drive units, effluent launders and manual skimmer. Handrail shall be provided.

(b) Fine screens.

(i) Number of units. A minimum of two units shall be provided. Multiple units shall be capable of independent operation. With the largest unit out of service, the remaining units shall be capable of passing the peak flow rate.

(ii) Flow distribution. Positive means of flow distribution shall be provided ahead of the screens to ensure even loading and hydraulic flows.

(iii) Design parameters.

(A) Performance. In the absence of pilot plant data, the removal efficiency of fine screens shall be assumed to be zero percent removal of BOD5 and 15 percent removal of suspended solids.

(B) Preliminary treatment requirement. Prior to the fine screens, removal of large debris shall be provided by coarse screens. Comminution shall not be provided ahead of screens.

(iv) Screenings storage and disposal. Screens with openings of 0.10 inch (2.5 mm) or more shall be disposed of directly to landfill in accordance with the requirements of the Department of Environmental Quality, Solid Waste Management Office. Screens with openings less than 0.10 inch (2.5 mm) shall discharge the screenings (primary sludge) to sludge handling system for

organic stabilization.

(v) Cleaning and maintenance. Provide facilities to permit regular cleaning of screens with a high pressure, hot water or steam system.

(vi) Controls. For rotating screens, each screen or series of screens shall be provided with an overflow. An alarm shall be provided when overflowing.

(c) Sludge handling.

(i) Sludge removal. Mechanical sludge collection equipment is required for all primary settling basins. The sludge collection rake arms or flights and the drive assembly shall be designed to withstand the maximum antici pated loads and move sludge to the hopper.

(ii) Scum removal. Provide scum collection and removal facilities for all primary settling basins. Scum shall be removed from the liquid process and not returned.

(iii) Sludge hopper. The minimum side slope of the hopper shall be 1.7 vertical to 1.0 horizontal. Hopper bottoms shall have a maximum dimension of two feet (0.61 m). The sludge removal pipe shall be flush with the hopper bottom, and have a minimum diameter of six inches (15.2 cm).

(iv) Scum box. The scum box shall be located outside and immediately adjacent to the scum collection point (beaching plate). The beaching plate shall be located on the opposite side of the basin from the prevailing wind. Provide for mixing the contents of the scum box, such as a mechanical mixer or air diffusion. Provide access and wash water for washing the scum box.

(v) Controls.

(A) Primary settling sludge facilities. Primary sludge and scum shall be removed using positive displacement pumps. Each basin shall have a separately activated and controlled pump. (The standby pumps may be shared by more than one basin.) Pumps shall be on timers and the pumps should be designed to initiate sludge removal two or more times per hour.

Include devices on the primary sludge piping for sampling the primary sludge flow.

(B) Primary screen sludge facilities. Where sludge pumping is pro-vided, include a means to shut off the pump when insufficient material is being supplied to the pump suction. The controls for the pump shall be designed to match the pumping rate to quantity of sludge. Where convey ors are used, they shall run continuously and alarm when off.

Section 14. Activated Sludge.

(a) Pretreatment. Where primary clarification is not provided, screening of the raw sewage to remove debris larger than 3/4 inch (1.9 cm) shall be provided. The screened material shall not be returned to the plant process. Where primary clarifiers are not provided, cleanouts, grinders, or other similar provisions shall be made in the return sludge piping.

(b) Loading rates. Activated sludge systems shall be designed to accommodate peak day loadings at the design year. Permissible loadings are presented in the following table. Where raw sewage BOD5 is less than 200 mg/L, detention times may be reduced.

(i) Conventional, including complete mix, plug flow, step aeration:

Average Day Detention (*) hrs,	Following primary clarifiers	6 minimum
	Without primary clarifiers	9 minimum
Organic Loading:	lb/1,000 cu ft/day (kg/1000 mñd)	35 maximum (560)
MLSS, mg/L		1,000 - 3,000

(ii) Contact stabilization.

Detention (*) hrs,	
Contact Zone	0.5 - 3
Sludge Stabilization Zone	6 minimum
Average Day Organic Loading (**) lb/1,000 cu ft/day (kg/1000 mñd)	50 (800)
MLSS, mg/L	
Contact Zone	1,000 - 3,000
Sludge Stabilization Zone	5,000 - 10,000

(iii) Extended aeration, including oxidation ditch.

Detention (*) hrs,	16 minimum
Organic Loading, lb/1,000 cu ft/day (kg/1000 mñd)	15 maximum (240)
MLSS, mg/L	1,000 - 3,000

(*) Based on average day raw sewage flow rate exclusive of recirculation flow.

(**) Based on contact zone and sludge stabilization zone combined.

(c) Number of basins. For all design average flows in excess of 0.1 mgd (378 mñ/d), two or more aeration basins shall be provided. For flows less than 0.1 mgd (378 mñ/d), one aeration basin may be provided if the aeration devices can be readily removed while the basin is in operation.

(d) Configuration. The basin configuration shall promote mixing, transfer of oxygen, and minimize stagnant zones.

(e) Freeboard. The walls of the aeration shall extend above the normal water surface to provide a minimum freeboard as follows:

Minimum Freeboard (*)	inches	cm
Diffused air	18	45.7
Surface aeration	48	121.9
Submerged turbine	18	45.7
Brush aeration, less than 10 feet from aeration device	48	121.9
Brush aeration, 10 feet or more from aeration device	18	45.7
Surface aeration, where aeration is 30 or more feet from basin wall	36	91.40

(*) Vertical walls. For sloped walls, the runup effect shall be considered.

(f) Inlet and outlet conditions. Inlets may be submerged and shall be baffled or directed away from the outlet to minimize shortcircuiting. Outlets shall be of the overflow type to discourage buildup of foam and floatables on the aeration basins. Pipe and channels shall provide a minimum velocity of 0.5 fps (0.15 m/s).

(g) Aeration requirements.

(i) Carbonaceous BOD? . When it can be shown that nitrification will not occur in the activated sludge process, the aeration devices may be sized to meet only the carbonaceous oxygen demand. The oxygen provided by the aeration device shall be selected to be adequate for the projected maximum day loading. In the absence of other data, an oxygen requirement of two times the average design day BOD? to the aeration basin shall be used.

(ii) Nitrification. Where nitrification is required to meet the effluent requirements or where the process cannot be operated to prevent nitrification, the aeration requirements will be selected to provide oxygen for both carbonaceous BOD? and nitrification on the projected maximum day loading. In the absence of other data, an oxygen requirement of two times the average design day BOD5 plus 7.5 times the average day ammonia nitrogen to the aeration basin shall be used.

(iii) Minimum dissolved oxygen. Oxygen supply shall be selected to transfer the design quantity during the maximum day loading while maintaining an aeration basin dissolved oxygen of 2.0 mg/L. The oxygen supply shall be designed for the specific site considering all factors that affect oxygen transfer efficiency.

(h) Mechanical aeration. Mechanical surface aerators shall be designed to maintain all organics in suspension, enhance the oxygen transfer capability of the unit, and minimize mist and spray that escape the basin. Drive units shall be protected from freezing mist and spray.

(i) Diffused aeration.

(i) Diffuser requirements. The number and location of diffusers shall be selected to distribute the design air quantity for efficient aeration and mixing. Diffusers in a basin shall be grouped on control valves to permit varying the air supply to different parts of the basin. Oxygen transfer efficiencies used for design purposes shall be conservatively selected, based on experimentally determined transfer rates of generically similar diffusers. The effect of transferring oxygen to wastewater, in lieu of water, and the effect of altitude shall be considered. The aeration basin middepth shall be used to determine the oxygen saturation concentration. Differential head loss to individ ual diffuser inlets shall not be more than 0.2 psi (14 gm/cm²).

(ii) Blower requirements. Blowers shall be sized to provide the air requirements for the aeration basins and other plant uses of low pressure air. The inlet air to the blowers shall be filtered or otherwise conditioned to effectively remove dust and other particulate material. Removal of particulate material for fine bubble diffusers shall be designed for 95 percent of 0.3 micron. Filters designed for blowers shall be easily replaceable. Blower intakes shall be located to avoid clogging from drifting snow. Blowers shall be housed. The housing shall be ventilated to prevent more than a 15@ F (8@ C) temperature rise with all blowers operating, excepting the standby blower. The housing, blowers, and blower piping shall be arranged to permit removal of individual blowers while all other blowers are operating. Noise attenuating materials shall be used in the building interior. Blower systems shall be designed to permit varying the volume of air delivered. Blower motors shall be of a size to operate the blower throughout the range of ambient air temperatures experienced at the plant site.

(j) Sludge recirculation and waste.

(i) Rates. Sludge recirculation from the secondary settling basin to the aeration basin shall be variable within 25 to 100 percent of the average design flow. Sludge wasting from the activated sludge process may be from the mixed liquor or the return sludge. Sludge wasting shall be variable to enable wasting 1/2 of the total system solids in one day to zero wasting.

(k) Equipment requirements.

(i) Return sludge. Return sludge pumping shall be variable. The return sludge rate from each secondary settling unit and the rate to each aeration basin shall be controllable. Pumps shall be housed in heated, ventilated space. The pump floor shall be sloped and drained. Valves shall permit isolating each pump. Pumps and piping shall be arranged to allow ready removal of each pump. Check valves shall be provided where backflow through the pump could occur. Check valves shall be located in the horizontal.

Pump suction and discharge shall be three inches (7.6 cm) minimum. Sludge piping shall be four inches (10.2 cm) or larger. Cleanouts and couplings shall be provided in sludge piping to enable cleaning the pipe or to remove pumping equipment. All pipe high points shall be provided with air releases. All sludge piping shall be metallic material. Should air lift pumps be used, the units shall be designed with a minimum of 80 percent static submergence.

(ii) Waste sludge. If separate waste sludge pumps are provided, the rate shall be

controlled by timers or variable speed devices. Pumping units shall be housed in heated, ventilated space, with sloped and drained floors. Pump suction and discharge piping shall be three inches (7.6 cm) minimum. Sludge piping shall be four inches (10.2 cm) or larger, except short, easily removable sections that may be required to maintain velocities above one fps (0.3 mps), or for use in conjunction with meters.

(l) Metering.

(i) Return sludge. For treatment plants having an average day design capacity greater than 100,000 gpd (378 mñ/d) the return sludge flow rate from each secondary settling unit and to each aeration basin shall be metered to indicate flow rate. Return sludge metering devices shall be suitable for liquids carrying grease and solids, and shall be accurate to within ±5 percent of the actual flow rate. Meters shall be readily field calibrated by plant personnel. Meters shall be arranged to avoid trapping air.

(ii) Waste sludge. For treatment plants having an average day design capacity greater than 100,000 gpd (378 mñ/d), waste sludge flows shall be metered to indicate and totalize. Waste sludge meters shall meet the requirements described for return sludge meters.

(iii) Air flow. Low pressure air used for basin aeration and other plant uses shall be metered. Separate meters shall be used to indicate the flow rate to each aeration basin and to the ancillary uses made of the low pressure air. Indicators shall be located near the device used to control the air flow rate. Pressure gages shall be provided immediately downstream from each blower and immedi ately upstream of each aeration basin.

(m) Controls. Facilities for control shall be provided for:

(i) Control of flow split between parallel process units.

(ii) Control of return sludge flow rate to each aeration basin.

(iii) Control of waste sludge quantity.

(iv) Control of air flow rate to each aeration basin.

(v) Control of air distribution to different zones in aeration basin.

(vi) Control of energy imparted with mechanical aeration.

Facilities for control shall include a meter or device to measure rate and a device to change the rate such as a valve or adjustable weir.

(n) Prefabricated treatment units. Prefabricated activated sludge units shall conform to the applicable requirements described.

(o) Ancillary facilities. Adequate nonpotable washdown water shall be provided around the aeration basins sludge pumping area and secondary settling basins. Sampling ports, pipes or other

access shall be provided on aeration basin inlets, return sludge piping, waste sludge piping and secondary settling basins. Hoisting or other means of equipment removal shall be provided. All subgrade floors shall be drained.

Section 15. Attached Growth Systems.

(a) Pretreatment and primary treatment requirements. Attached growth systems shall be preceded by primary settling or fine screening. If fine screening is provided, the screen size shall have 0.06 inch (1.5 mm) or smaller openings.

(b) Trickling filters.

(i) Loading rates. Applied organic loading rates on trickling filters, where not used in series with activated sludge, shall be limited to:

	Applied Liquid Rate									
to Surface of Filter	BOD Loading *	(gpm/sf)	(1pm/m²)	lb/1000ftñ/d	kg/1000mñ/d					
Rock Media	0.1	4.07	10	160						
	0.2	8.15	12	192						
	0.3	12.22	16	256	Plastic or	-	-	20	320	
Redwood Media										

*For more than a one-stage trickling filter, the volume of all stages shall be used.

(ii) Recirculation. Recirculated flow to stationary media attached growth systems shall be provided. Recirculated flow shall be sufficient to provide the follow ing minimum wetting rates:

Media	Minimum Wetting Rate				
	(gpm/sf)	(1pm/m²)	Rock	0.1	4.07
Plastic or redwood	0.75	30.5			

(iii) Media. Media may be rock or specially manufactured material made of redwood or plastic. Rocks shall be durable and free from thin, elongated, flat pieces and should have the following size distribution:

Fabricated media shall be resistant to ultraviolet degradation, disintegration, erosion, aging, all common acids, alkalies, organic compounds, fungus and biological attack. Media shall be capable of supporting a man’s weight.

(iv) Flow distribution. Wastewater shall be applied to stationary media by a rotary distributor or a fixed nozzle distribution system that provides uniform distribution. Flow distribution between multiple units of stationary or rotating media systems shall be by weirs, meters and valves, or other positive flow split device.

(v) Depth of media. Rock trickling filters depth shall be between 5 to 10 feet (1.52

to 3.04 m), and manufactured media filter depth shall be between 10 to 30 feet (3.05 to 9.15 m).

(vi) Underdrain system. The underdrainage system shall cover the entire floor of the filter. Inlet openings into the underdrains shall have an unsubmerged gross combined area equal to at least 15 percent of the surface area of the filter. Underdrains shall have a minimum slope of one percent.

Effluent channels shall be designed to maintain minimum velocity of two feet per second (0.61 mps). Drains, channels and pipe shall be designed to have maximum depth flow of 50 percent.

(vii) Flushing. Provide valves and structurally capable walls to permit flooding rock media filters. Access shall be provided around the periphery of the underdrain system to allow flushing the underdrains.

(viii) Freeboard. The clearance between rotating distributor and the media shall be at least 18 inches (0.46 m). Vhe surrounding wall shall extend 2.5 feet (0.76 m) above the distributor.

(ix) Ventilation. All trickling filters shall be provided with ventilation openings to the underdrain. Ventilation openings will be provided with dampers or other adjustable devices to permit adjusting the ventilation rate opening. Ventilation openings shall be a minimum of eight square feet (0.74 m^2) per 1,000 lb (454 kg) BOD? /day.

Forced ventilation providing 4,000 cfm (113 mñ/min) per 1,000 lb (454 kg) BOD /day shall be provided for covered filters.

(c) Rotating biological contactors (RBC).

(i) Loading rates. The organic loading rate on the first stage of an RBC shall be limited to 140 lb BOD? /1,000 cu ft (2240 kg/1,000 mñ) of media per day. The organic loading rate on all stages of an RBC shall be limited to 45 lb/1,000 cu ft (720 kg/1,000 ñm) of media for media having a specific surface area of 35 sq ft per cu ft (114.8 sq m/mñ). When more than 1/2 of the media has a specific surface area of 50 sq ft per cu ft (164 sq m/mñ), the organic loading may be increased to 50 lb/ 1,000 cu ft (800 kg/1,000 mñ).

(ii) Number of stages. Rotating biological contactors shall be designed with a minimum of three stages in series. Baffles shall be provided between stages.

(iii) Velocities. The rotational speed of the contactors shall be designed to maintain at least two mg/L of dissolved oxygen in each stage at designed loading rates. Drive units shall provide a rotational speed of one rpm or more.

(iv) Draining. Provide drains from each contactor basin.

(v) Media materials. Media materials shall be special manufactured material suitable and durable for the rotating biological contactor process. Media shall be resistant to disintegration, ultraviolet degradation, erosion, aging, all common acids, alkalies, organic com pounds, fungus, and biological attack. Media shafts shall be designed for unbalanced loads and cycle fatigue.

(vi) Housing. The housing for the RBC'S shall be designed with openings or access to allow removal and replacement of entire shafts.

Section 16. Combination systems. When more than one type of biological treatment process is used in series, the removal through each biological unit shall be calculated as if it were acting alone. No symbiotic effect will be included in the design calculation.

Pretreatment requirements for combinations of biological systems will be the same as for attached growth systems. Final settling and sludge handling will be the same as for activated sludge systems.

Section 17. Secondary settling.

(a) Secondary settling. Secondary settling is required after suspended growth and attached growth biological processes such as activated sludge, trickling filters and RBC's.

(b) Configuration. The largest dimension (either diameter or length) of a clarifier shall be 80 feet (24.4 m). Corner sweeps on circular equipment are not acceptable.

(c) Flow distribution. Positive flow splitting shall be provided ahead of multiple sedimentation basins to ensure proportional hydraulic flows and solid loadings to each basin. Flow splitting shall be achieved using positive means such as weirs or valves and meters.

(d) Clarifier inlet and outlet structures.

(i) Clarifier inlet structures shall be designed to dissipate the:

(A) Inlet kinetic energy.

(B) Distribute the flow evenly into the basin.

(C) Minimize hydraulic turbulence.

(D) Prevent short circuiting.

Inlet devices that promote flocculation are encouraged. The inlet structure for rectangular tanks shall be the full width of the basin, for peripheral feed clarifiers it shall be the entire periphery, and for center feed basins it shall be at least 20 percent of the tank diameter. Baffled scum relief ports shall be provided between the inlet structure and the clarifier.

(ii) Inlet conveyance pipe or channels shall be designed to maintain a minimum velocity of 0.5 fps (0.15 mps) at the design flow. Where channels provide less velocity, provide mixing, flushing, or other means of resuspending solids.

(iii) Clarifier outlet systems shall be designed to minimize vertical velocities and reduce the effect of density currents at the effluent weir. Weir level shall be adjustable.

(e) Freeboard. The outer walls of settling tanks shall extend at least six inches (0.15 m) above the surround ing ground and provide at least 12 inches (0.3 m) of free board to the water surface. Where settling basin walls are less than four feet (1.22 m) above the surrounding ground, a fence or other debris barrier shall be provided on the wall.

(f) Design parameters.

(i) Surface overflow rates.

(A) Activated sludge. Settling basins following an activated sludge process shall be designed to both thicken the sludge and clarify the liquid flow entering the tanks. The overflow rate shall not exceed:

Design Flow	Peak Hourly Flow gpd/ft²	mñ/m²/d	gpd/ft²	mñ/m²/d
Activated Sludge	600	24.4	1,200	48.8
Separate Nitrification	400	16.3	800	32.5

(B) Attached growth biological reactors. Overflow rates for settling basins following attached growth processes shall not exceed:

Design Flow	Peak Hourly Flow gpd/ft²	mñ/m²/d	gpd/ft²	mñ/m²/d
Tricklings Filter and RBC's	800	32.5	1,200	48.8

(ii) Solids loadings. Solids loadings for settling basins following an activated sludge process shall not exceed:

Design Flow	Peak Hourly Flow lbs/day/ft²	kg/d/m²	lbs/day/ft²	kg/d/m²
All Activated Sludge Processes	28	136.7	50	244.1
Separate Nitrification	25	122.1	40	195.3

(iii) Side water depth. Settling basins shall be deep enough to provide adequate distance between the sludge blanket and the effluent weirs to avoid disturbance of settled sludge.

The volume of the settling basin shall provide a minimum detention time of two hours at peak hourly flow rate. The peak hourly flow is the projected maximum flow over a one hour period during the design year. Peak hourly flow shall include all recycle flows entering clarifier.

(iv) Weir overflow rates and placement. Weir loading rates shall not exceed the following values:

Design Flow	Peak Hourly Flow gpd/ft²	mñ/m²/d	gpd/ft²	mñ/m²/d
Launder and weir at	12,000	149	20,000	248

outer wall				
Launder and weir at 3/4 point of radius or less	18,000	223	36,000	446

Where double weirs or serpentine type weirs are used, the weir length shall be computed as the length of the centerline of the launder.

(g) Baffles. Baffles shall be located at the water surface and in such a position as to intercept all floating materials (scum) prior to the weirs. Baffles shall extend three inches (7.6 cm) above the weir level and 12 inches (0.3 m) below the water surface. In circular basins, the baffle shall be a minimum of six inches (0.15 m) inside the weir plate. In rectangular basins, the baffle shall extend across the width of the basin and upstream of the effluent weirs.

(h) Basin and equipment access. Walkways and access ways shall be provided to drive units, effluent launders, and manual scum devices.

(i) Sludge handling.

(i) Sludge removal. Sludge collection and withdrawal equipment shall provide complete and continuous removal of settled sludge. Rapid sludge removal pipes shall return sludge to a well at the surface that enables visual observation of flow. Mechanical rakes shall move sludge to a hopper at the floor. The tip speed for circular mechanisms shall not exceed 8 fpm (2.4 m/min) and straight line flight speed shall not exceed 1 fpm (0.3 m/min).

The return sludge removal pipes shall be at least four inches (10.2 cm) in diameter. The hydraulic differential between the clarifier water level and the return sludge level shall be sufficient to maintain a three fps (0.9 mps) velocity in each rapid return sludge withdrawal pipe. Each sludge withdrawal pipe shall be accessible for rodding or backflushing when the settling basin is in operation.

(ii) Scum removal. Provide effective baffling and scum collection and removal facilities for all secondary settling basins. Equipment shall include a mechanical, positive scum skimmer.

(iii) Sludge hopper. The minimum side slope of the hopper shall be 1.7 vertical to 1.0 horizontal. Hopper bottoms shall have a maximum dimension of two feet (0.61 m). The sludge removal pipe should be flush with hopper bottom, and have a minimum diameter of six inches (0.15 m).

(iv) Scum box. Locate scum box outside settling tank and adjacent to the scum collection point. Provide method for mixing contents of scum box, such as air jets or surface wetting using waste sludge. Provide access and washwater for washing the scum box. The scum box shall be located on the side of the tank opposite the prevailing wind direction.

Section 18. Lagoons.

(a) Design requirements.

(i) Location. Wastewater lagoons shall be located more than 500 feet (152 m) from existing habitations.

(ii) Wastewater loading rates.

(A) Facultative. The primary cells of a facultative (non-aerated) pond system shall be limited to a maximum BOD application of 40 lb/acre/day (44.8 kg/ha/d) at average design loading conditions.

(B) Aerated. Aerated lagoons shall be designed for an organic loading of less than 10 lb BOD /day/1,000 cu ft (160 kg/1,000 mñ/d) for completely mixed systems, and less than two lb BOD5/day/1,000 cu ft (32 kg/1,000 mñ/d) for aerated non-completely mixed systems. Aeration equipment shall be sized to maintain a minimum dissolved oxygen of two mg/L. Completely mixed systems are mixed to provide 1/4 hp/1000 cu ft mechanical mixing or 10 cfm/1000 cu ft of air mixing.

(C) Nonsurface water discharging ponds. Nonsurface water discharging ponds shall be designed on the basis of a water balance that considers evaporation and seepage. Water balance calculations shall be submitted with the plans and specifications. The BOD5 loading for non discharging ponds shall not exceed 14 lb/acre/day (15.7 kg/ha/d) based on the average annual BOD5.

(iii) Detention. Facultative lagoons shall be designed for a minimum detention time of 180 days.

The detention time in aerated lagoons shall be at least one and one half days for completely mixed primary cells, and seven days for noncompletely mixed primary cells. Secondary cells shall increase the overall detention time to 30 days.

(iv) Storage. Nonsurface water discharging lagoons shall be designed to provide sufficient storage to retain all wastewater and rainfall during the wettest year of record during a ten year period of record. Seepage shall be controlled to maintain a minimum water depth of two feet (0.6 m) in the primary cell during the driest occurring year of a ten year period.

(v) Inlet.

(A) Location. The inlet pipe to the primary cell of a facultative lagoon shall be at least 30 feet (9.2 m) from any bank. It shall terminate at a point away from the outlet by a distance of at least equal to or greater than 2/3 of the longest lagoon dimension. In aerated systems, the influent line shall be located in the mixing zone of the aeration equipment.

(B) Elevation. The inlet line shall be located on the bottom of the lagoon.

(C) Apron. Provide a concrete apron at the inlet pipe termination with minimum dimensions of four feet by four feet (1.2 m by 1.2 m).

(D) Influent manhole. An influent man-hole shall be provided prior to the lagoons. The influent pipe in the influent manhole shall be at least six inches (0.15 m) above the nor-

mal operating water level of the primary lagoons.

(E) Flow distribution. Flow distribution for multiple primary cells shall be provided to effectively split hydraulic and solids proportionately.

(vi) Inlet and outlet structures.

(A) Location. Inlet and outlet structures shall be easily accessible by plant operators and located to minimize short circuiting within the cell. A level control structure shall be provided at the outlet of each cell.

(B) Level control. Provide controls to permit varying water levels between two feet and six feet (0.6 m to 1.8 m). Provide baffling at the outlet to prevent scum overflow. Multiple draw offs in the final cell shall be provided. At least one shall be located at the two foot (0.6 m) level.

(vii) Interconnecting piping.

(A) Location. Piping between lagoon cells shall connect to the preceding cell outlet control structure and discharge into the subsequent cell. The pipe shall discharge at least ten feet (3.05 m) from the toe of the slope on the lagoon bottom and shall terminate on the concrete apron that is at least four feet by four feet (1.2 m by 1.2 m).

(B) Elevation. The piping shall discharge at the floor of the lagoon.

(C) Material. Interconnecting piping shall be any acceptable pipe designed to resist low pressures and adequately protected from corrosion.

(b) Number of lagoons cells. A lagoon system with a total area greater than one acre (0.4 ha) shall have at least three cells in series. Smaller systems and nondischarge pond systems shall have at least two cells. The maximum size cell shall be 20 acres (8 ha).

(c) Lagoon configuration.

(i) Shape. Rectangular cells shall have a maximum length to width ratio of 5:1. No sharp corners nor dead-end coves are permitted.

(ii) Water depth. Facultative ponds shall be designed to have water depths of not less than two feet, nor more than six feet (0.61 m to 1.8 m). Aerated lagoons shall be designed to have water depths of not less than four feet nor more than 15 feet (1.2 m to 4.6 m).

(iii) Removal of lagoon cells from operation. Bypass piping for primary lagoon cells and aerated lagoon cells shall be provided.

(iv) Lagoon freeboard. A minimum freeboard of two feet (0.6 m) shall be provided. Greater freeboard shall be provided for wave runup, where required.

(d) Construction requirements.

(i) Dike.

(A) Material. Dikes and embankments shall be of relatively impervious and stable material, and compacted to at least 95 percent of maximum density (ASTM D698-78). Embankment fill shall be free from organic material, rock larger than six inches (15.2 cm) and construc tion debris. The area where the embankment is to be con structed shall be stripped of vegetation and roots.

(B) Top width. Dikes and embankments shall be constructed with minimum top width of eight feet (2.4 m).

(C) Slopes. Interior slopes shall be from three to four horizontal to one vertical, and shall be stable under varying water level conditions. Interior slopes that are surfaced with concrete paving or riprap may be constructed at slopes of two or more horizontal to one vertical. Exterior slopes shall be three or more horizontal to one vertical and shall prevent the entrance of surface water to the lagoon.

(ii) Seeding. Exterior slopes and interior slopes that are not riprapped shall be seeded with dryland grasses, unless another equivalent method for soil erosion control is provided.

(iii) Erosion control. Interior embankments except cells smaller than one acre shall be protected from wave action with riprap, paving, or other erosion resistant material, unless it is demonstrated that the ponds are sheltered from wind or where wind velocity is low and erosion will not occur.

(e) Lagoon sealing.

(i) Lagoon sealing. The seepage through the pond bottom and side walls shall not cause a violation of the groundwater standards as described in Chapter VIII (Quality Standards for Wyoming Groundwaters) of the Wyoming Department of Environmental Quality, Water Quality Rules and Regula tions. Liners shall be required if the wastewater character istics or site conditions will not insure the protection of the groundwater for which it is classified.

If the applicant cannot document that the facility poses no threat to groundwater and elects not to perform a subsur face study in accordance with Chapter III, Section 15 (a) and (b), then the groundwater shall be protected from contamina tion by the wastewater with a liner equivalent to three feet (1 m) of soil having a permeability of 10-7cm/sec or less. When an applicant performs a subsurface study, the require ments for the liner shall be determined based on the results of the study and the groundwater protection required. In no instance shall the maximum seepage rate exceed 1/8 inch per day (3.2 mm/day) in the primary pond(s).

Following construction of the lagoons, but prior to startup, a testing program shall be conducted to demonstrate the effectiveness of the sealing program. Should the testing program show the lagoon seal to be less effective than the above requirements, the seal shall be modified and retested until it succeeds.

(ii) Synthetic liners.

(A) Material. Synthetic liners shall be essentially impervious. The minimum lining thickness shall be 30 mils. The liner material shall be resistant to organic materials typical of sewage. The liner shall be resistant to sunlight or shall be covered with 12 inches (30.5 cm) or more of soil at all locations including the lagoon bottom and side slopes.

(B) Liner stabilization. Where the seasonal high groundwater is above the bottom of the lagoon, the liner shall be stabilized to prevent it from rising.

(C) Appurtenances. A leak detection system and/or air release mechanism may be required.

(f) Aerated systems.

(i) Air requirements. Aerated ponds shall be designed to maintain 2 mg/L of dissolved oxygen or more throughout the pond contents.

(ii) Equipment requirements.

(A) Number. Surface aerators shall be provided at intervals of 200 feet (61 m) or less. The lagoon shall be protected from erosion from the aeration equipment. At least two surface aerators or brush aerators shall be provided. With the largest unit out, the remaining units shall be capable of transferring the average day oxygen demand. Each diffused aeration system shall be provided with at least two blowers. With the largest blower out of service, the remainder shall be capable of supplying the design air flow rate.

(B) Removal. All equipment shall be accessible and removable from the edge of the lagoons. Provisions for dewatering shall be made for removal or repair of diffusers.

Section 19. Tertiary treatment systems.

(a) Phosphorus removal.

(i) Equipment requirements.

(A) Flash mixing. Chemical addition points shall be at points of high turbulence, such as Parshall flumes, hydraulic jumps, or separate mixing basins.

(B) Flocculation. Inlet and outlet design shall prevent short circuiting and turbulent destruc tion of floc. Minimum detention time shall be 20 minutes at the average design flow rate.

The velocity of flocculated water to settling basins shall be 0.5 to 1.5 fps (0.15 to 0.46 mps). Changes in direction shall be with long radius elbows or curved chan nels.

(C) Chemical feed equipment. Storage shall be provided for at least 14 days of chemical supply. Liquid chemical storage tanks shall have a liquid level indicator, an overflow, and a receiving basin capable of holding 110 percent of the stored volume, or a drain capable of receiving accidental spills or overflows. Liquid chemical storage shall be provided with heat.

(b) Ammonia nitrogen reduction.

(i) Activated sludge. Ammonia nitrogen removal by activated sludge processes shall be designed with sludge retention time of at least 15 days and shall provide at least 16 hours of hydraulic detention time. Aeration requirements are described in Section 15.

(ii) Attached growth. Rock media trickling filters shall not be used for ammonia reduction. Fabricated media trickling filters used for ammonia shall be designed using a BOD loading of less than 14 lb/1000 cu ft (224 kg/1,000 mñ) of media. Rotating biological contactors used for ammonia reduction shall be designed with hydraulic loadings less than 1.0 gpd/sq ft (40.7 L/m²/d) of media
surface area. At least four stages shall be provided for ammonia nitrogen removal.

(iii) Lagoons. The design of facultative lagoons for ammonia removal shall provide a minimum detention of 180 days. Aerated lagoon systems may be designed for 160 days.

(c) Solids reduction.

(i) Filtration.

(A) Filtration rate. The maximum hydraulic loading for 24 inch (61 cm) or deeper media is 5 gpm/sq ft (292.5 mñ/m²/d) of filter area. Filtration rates for shallower media shall be limited to 3gpm/sq ft (175 mñ/m²d).

(B) Backwash requirements. Provide a minimum backwash rate of 20 gpm per square foot (1170 mñ/m²/d) of filter bed for 24 inch (61 cm) or deeper media and 12 gpm/square foot (702 mñ/m²/d) for shallower media; supply shall be filtered water. A rate of flow regulator on the main backwash line shall be provided. The total backwash water storage capacity shall be adequate for 20 minutes of continuous backwash.

Air scour or surface wash facilities are required. All surface wash devices shall be provided with a minimum flow rate of 0.5 gpm per sq ft (29.3 mñ/m²d) water pressures of 50 psi (3.52 kg/cm²) or greater and use filtered water.

(C) Backwash waste handling and treat ment. Waste filter backwash shall be collected in a surge tank and recycled to the treatment plant at a rate not to exceed ten percent of the average plant design flow rate. Waste backwash water may be returned to any point upstream of the biological treatment units.

(D) Number of units. At least two units shall be provided. With one filter out of service, the remaining filters shall be capable of passing the maximum day design flow rate.

(E) Controls. Controls should be provided to remove a filter from service, backwash the filter, and return it to service. Where the control is automatic, there shall also be a means of manually overriding the operating equipment, including each valve essential to filter operation.

In addition, the following shall be provided:

(I) Sampling tap on filter influent and effluent.

(II) Indicating and recording loss of head gauge.

(III) Flow rate indicating and control.

(IV) Means for feeding polymer as a filter aid at a controlled rate to filter influent water when chemically coagulated effluent is being filtered.

(ii) Microscreens.

(A) Pilot testing. Pilot plant testing on the fluid to be screened or data from other similar applications to demonstrate the suitability of the proposed filter fabric, fabric life, proposed loading rates, and other design criteria shall be provided.

(B) Loading rates. Flow equalization facilities shall be included in the design to moderate influent quality and flow variations.

The screening rate shall be selected to be compatible with available pilot plant test results and selected screen aperture, but shall not exceed 1.5 gpm/sq ft (87.8 mñ/m²/d) for lagoon effluent or 5 gpm/sq ft (292.5 mñ/m²/d) for activated sludge or attached growth effluents based on the maximum hydraulic flow rate applied to the units. The screening rate shall not exceed 0.75 lb/sq ft/day (3.7 kg/m²/day). The effective screen area shall be considered the submerged screen surface area less the area of screen blocked by structural supports and fasteners.

(C) Backwash requirements. The backwash water shall be at least eight gpm/linear foot (9 Lpm/m) of screen length at 60 psi (4.2 kg/cm?), obtained from microscreened effluent.

(D) Controls. Each microscreen unit shall be provided with automatic drum speed controls with provisions for manual override.

(d) Rapid infiltration.

(i) Wastewater preapplication requirements.
Rapid infiltration shall be preceded by settling or fine screening having 0.6 inch (1.5 mm) or smaller openings.

(ii) Hydraulic loading rates.

(A) Permeability. Hydraulic capacity of the rapid infiltration site shall be based upon soil perme ability, basin infiltration tests, or cylinder infiltrometer tests. Design loading rates based on these tests shall be as follows:

Field Measurement	Annual Loading Rate

Basin infiltration test	10% of minimum measure rate
Cylinder infiltrometer	2% of minimum measured rate
Permeability	5% of conductivity of most restricting soil layer

(B) Precipitation. The total hydraulic load to the rapid infiltration basins includes precipitation. The one in ten year precipitation event should be used as the basis for design.

(C) Cold weather conditions. The design must recognize that drying rates, oxidation rates, nitrifica tion and denitrification rates all decrease in cold weather. Cold weather loading rates shall be used to determined land requirements or cold weather storage shall be used. Provi sions should be made to mow and disc basin surfaces in the fall to prevent ice from freezing the vegetation near the soil surface. Snow fences can be used to keep snow cover on the rapid infiltration basins to insulate the applied wastewater and soil.

(iii) Land requirements.

(A) Storage. A minimum of 14 days of storage shall be provided. Where applied sewage will be less than 4@ C, 160 days of effluent storage shall be provided.

(B) Location. Rapid infiltration basins shall be located more than 500 feet (152 m) from existing habitation.

(iv) Basin size. Individual basin size shall not be greater than five acres (2.0 ha). Basin sizing should be based upon a maximum water depth of 12 inches (30.5 cm) in the rapid infiltration basins.

(v) Subsurface drainage. The capillary fringe above the groundwater mound shall not be closer than two feet (0.6 m) to the bottom of the infiltration basin. The distance to groundwater shall be at least five feet (1.5 m) below the soil surface within two days following wastewater application.

(vi) Groundwater monitoring. Refer to Chapter III, Section 15, of the regulations.

(e) Intermittent sand filters.

(i) Wastewater preapplications treatment requirements. Intermittent sand filters shall be preceded by settling or fine screens having 0.06 inch (1.5 mm) or smaller openings.

(ii) Hydraulic loading rates. The maximum application rates shall be limited to:

Maximum Application Rate Source	gallons/acre/day	(mñ/ha/d)
Primary Effluent	130,000	(100)
Secondary Effluent	400,000	(611)
Lagoon Effluent	300,000	(458)

(iii) Media. The minimum sand depth shall be 24 inches (0.6 m). The sand must be free of cementing materials and clay or loam. The sand should have an effective size of not less than 0.2 mm and not greater than 0.5 mm, and a uniformity coefficient of less than 5.

Clean graded gravel shall be placed around the under drains and to a depth of at least 12 inches (0.3 m) over the top of the underdrains.

(iv) Underdrains. All intermittent sand filters shall be provided with underdrains. Underdrains shall be at least four inches (10.2 cm) in diameter. The under-drain pipe shall have a minimum slope of 5 feet per 1,000 feet (5 m/1,000 m).

The groundwater shall be at least two feet (0.6 m) below the bottom of the underdrain pipe.

(v) Number of units. Three or more filters shall be provided.

(vi) Dosing.

(A) In each dosage of an intermittent filter, the hydraulic capacity shall permit covering the bed to a depth of two inches (5 cm), within 20 minutes or less.

Section 20. Sludge Handling, Treatment and Disposal.

(a) Pumping.

(i) Design requirements. Sludge pumps shall be provided with a positive suction pressure at the pump impeller, rotor or plunger at dynamic conditions. Discharge pressure shall include static pressure difference and system friction losses based on the higher viscosity of the sludge than water.

(ii) Piping and valves.

(A) Minimum size. Sludge piping and valves shall at least four inches (10.2 cm) in diameter for pressure piping and six inches (15.2 cm) in diameter for gravity pipe. Pump suction and discharge shall not be less than three inches (6.6 cm) in diameter.

(B) Minimum velocity. For sludge pipes larger than four inches (10.2 cm) in diameter, the minimum velocity shall be one fps (0.3 m/sec).

(b) Thickening.

(i) Types.

(A) Gravity. Gravity thickening shall only be used for primary sludge, digested primary sludge, lime sludge, or combinations of lime sludge, trickling filter humus and primary sludge.

(B) Dissolved air flotation. Dissolved air flotation shall only be used for

combination of primary and biological sludges, waste biological sludges, and aluminum and iron salt sludges.

(ii) Design parameters.

(A) Influent solids concentration. The design for influent solids concentrations to gravity or flotation thickeners shall be 5,000 mg/L or less, except tertiary lime sludge.

(B) Operating schedule. Sludge thickening facilities shall have the capacity to treat the maximum amount of solids produced. Where intermittent operation is provided, sludge holding tanks ahead of and after the thickening process shall be provided.

(C) Solids loading. Solids loadings (solids applied to the thickener) on thickening devices shall be limited to the following maximum values.

	Solids Loading			
	lb/sq ft/day		kg/m²/d	
Dissolved	Dissolved Air		Air	
Sludge Type	Gravity	Flotation	Gravity	Flotation
Primary	24	NA	117.2	
Digested primary	20	NA	97.6	
Waste activated,				
without polymer	NA	12		58.6
with polymer		48		234.3
Primary and				
trickling filter	15	--	73.2	
Anaerobically				
digested primary				
and activated	NA	NA		
Primary and lime	20	NA	97.6	
Tertiary lime	60	NA	292.9	
Alum	NA	12	58.6	

*NA - Not allowed.

(D) Hydraulic loading. Gravity thickeners shall be designed for 400-800 gpd/sq ft (16.3 mñ/m²/d to 32.5 mñ/m²/d) of surface area.

(iii) Number of units. Unless sludge storage capacity for three days is provided, there shall be at least two units of equal capacity provided for sludge thickening.

(iv) Controls. Controls for gravity and flotation sludge thickening operations shall include provision for influent flow rate control. Centrifuge thickening shall include adjustable manual controls for differential scroll speed, pool depth, and influent flow rate. Where chemical conditioning is required, chemical dosage rate shall have adjustable manual controls.

(v) Side stream waste characteristics. The flow, organic load, and solids load in the thickener return flow to the plant shall be included in the plant design loadings.

(vi) Odor control. Provisions shall be made for the continuous chlorination of gravity thickener influent. Any thickening installation for anaerobically digested sludge shall make provisions for enclosing zones where the sludge or decant is exposed to atmosphere, exhausting the zone at an adequate rate to prevent escape of gas, and treating the exhaust air for removal of odor causing agents.

(c) Aerobic digestion.

(i) Solids retention time. Solids shall be retained in the aerobic digester for 30 days for primary sludge and 20 days for waste sludge from conventional activated sludge systems. Waste activated sludge from extended aeration systems shall be retained for a minimum of 10 days.

(ii) Mixing and aeration requirements. Aeration requirements shall include the oxygen requirements for BOD stabilization, nitrification of ammonia nitrogen in the sludge, and nitrification of organic nitrogen in raw sewage solids and biological solids. A minimum dissolved oxygen of 2 mg/l shall be maintained. Minimum aeration requirements shall be:

	CFM/1,000 lb	mñ/min/1,000 Sludge	solids/day kg/d
Extended Aeration	300	18.7	
Conventional Activated	800	50.0 Primary Sludge	2,000 131.0

The aerobic digester aeration shall be provided with nonclog diffused aeration. Mechanical surface aerators shall not be allowed. Aeration provisions shall be a minimum of 30 cfm/1,000 cu ft (30 mñ/min/1,000 mñ) of volume.

(iii) Number of digesters. Where aerobic digesters are used, two or more shall be provided for treatment plants having an average design capacity of 100,000 gpd or more. Multiple aerobic digesters shall be arranged to permit either parallel or series operation.

(iv) Supernatant removal and disposal. Supernatant shall be returned prior to the influent of the biologi cal treatment process.

(d) Anaerobic digestion.

(i) Sludge characteristics. The minimum sludge concentration for feed to anaerobic digesters is four percent.

(ii) Number of digesters. Two or more digesters shall be provided for treatment plants having an average design capacity of 100,000 gpd (378.4 mñ/d) or more.

(iii) Design requirements.

(A) Temperature. Primary anaerobic digesters shall be heated to provide a minimum temperature of 95@ F (35@ C). Controls shall maintain the digester tempera ture within ±5@ F (±2@ C).

(B) Mixing equipment. Digester mixing shall, as a minimum, provide control of scum accumulation at the gas/liquid interface. Mixing that is designed for increasing the effectiveness of the digester and thereby reducing detention time shall mix the entire tank contents. Mixing devices and their application rate that will be considered to provide high rate digestion are:

Volume	Per 1,000 cf	Per 1,000 mñ
Slow speed turbine mixers	0.25 hp	6.7 kw
Draft tube mechanical mixers	0.40 hp	14.1 kw
External pumps and jet nozzles	500 gpm	66.7 mñ/m
Gas mixing applied at bottom of digester	10 cfm	10 mñ/m

Less mixing may be provided; however, longer solids retention times than described below shall be required.

(C) Solids retention time. The minimum solids retention time for heated, primary digesters are:

Unmixed	Completely mixed
30 days	10 days

Solids retention time shall be the same as liquid retention time in the primary digester where waste activated sludge is anaerobically digested.

(D) Volatile solids loading. As an alternative design basis to solids retention time, heated primary digesters may be designed for the following maximum volatile solids loading:

Unmixed
0.1 lb/ftñ/day (1.6 kg/mñ/d)

Completely mixed
0.3 lb ftñ/day (4.8 kg/mñ/d)

(iv) Sludge piping.

(A) Inlet. Except in completely mixed digesters, multiple inlets shall be provided. The piping shall provide the opportunity to heat undigested sludge prior to entering the digester.

(B) Sludge withdrawal. Except in completely mixed digesters, multiple withdrawal pipes shall be provided. One or more withdrawal pipes shall be from the digester floor.

(C) Supernatant withdrawal. The design basis for facilities using digesters for waste activated sludge shall assume no supernatant withdrawal. Piping for supernatant withdrawal may

be provided. A minimum of three supernatant withdrawal levels shall be provided otherwise.

(v) Gas system. All portions of the gas system, including the space above the tank liquor, storage facilities, and piping shall be designed to be under greater than atmospheric pressure at all times.

(A) Piping. Gas piping shall be 2.5 inches (6.4 cm) diameter or greater. Piping from the digester shall be provided with a flame trap. Piping shall slope to condensate traps. Float controlled condensate traps are not permitted.

(B) Safety equipment. All necessary safety equipment shall be included. Pressure and vacuum relief valves, flame traps and other safety equipment shall be provided. Gas safety equipment and gas compressors shall be housed in a separate room with an exterior entrance.

(C) Metering. A gas meter with bypass shall be provided for measurement of total gas production.

(vi) Heating equipment. Sludge and digester contents shall be heated with an external heat exchanger. Where sludge is heated using digester gas, an auxiliary fuel supply shall be provided. Boilers using digester gas shall be designed to minimize corrosion and to facilitate burner replacement. All digester gas that is not beneficially used shall be incinerated in a waste gas burner.

(vii) Access. The roof of the digester and the top sidewall shall be provided with sealed access hatches.

(viii) Sampling. One and one-half inches (3.8 cm) or larger sampling ports shall be provided for inlet sludge, effluent sludge, supernatant and digester contents.

(ix) Supernatant disposal. Supernatant from secondary digesters or from subsequent thickening or dewatering facilities for digested sludge shall be treated independently or returned immediately preceding the biologi cal process. Supernatant shall not be returned to the primary clarifier.

(e) Dewatering.

(i) Mechanical dewatering. Where provided, mechanical dewatering facilities shall include storage tanks for liquid sludge and shall provide for reliable use.

(ii) Drying beds.

(A) Gravity. Drying beds may be strictly evaporation or evaporation - percolation. Evaporation - percolation beds shall be provided with graded gravel and sand beds over perforated underdrain pipe. Evaporation beds shall be designed for the application of 1.5 feet (0.46 m) of sludge per year. Evaporation - percolation beds shall be designed for the application of four feet (1.2 m) of sludge per year. Storage of sludge in the beds or in separate basins shall provide 180 days of capacity. Percolate shall be returned to the plant ahead of the biological treatment process.

(B) Vacuum. The bed area for vacuum assisted open drying beds shall be

based on the application of no more than 40 feet (12.2 m) of liquid per year. If the beds are housed, the bed area shall be based on the applica tion of 80 feet (24.4 m) per year. Where beds are not housed, sludge storage shall be provided for 180 days of capacity. Polymer conditioning, chemical feed, chemical storage and facilities for mixing the polymer with the sludge shall be provided. Vacuum pumps, sump pumps, chemical feed equipment and motor control equipment shall be housed.

(iii) Filtrate disposal. Filtrate, centrate or underdrain liquid shall be returned to a point upstream of the biological treatment process. Centrate or filtrate shall not be returned upstream of the primary clarifier.

(f) Disposal.

(i) Degree of stabilization.

(A) Land application. Sludges shall be stabilized. Sludges that are to be used on public lands that are accessed by the public (parks, golf courses, cemeteries) or sludges that are to be made available to the public shall be composted or stabilized and stored for a period of at least one year. Sludges that are to be incorporated into the land shall be stabilized.

"Stabilized sludge" shall have reduced organic content and reduced pathogenic content. Stabilized sludge shall have less than 60 lb of BOD5 per 1,000 lb (60 kg/1,000 kg) of dry weight sludge solids.

(B) Landfill. Sludge processed for incorporation into a landfill shall be (1) a solid or semisolid material that will not release water upon standing, and (2) has been subjected to anaerobic or aerobic digestion, or chemically treated with lime to a pH of 12.0 or chemically treated with chlorine to a free chlorine residual. Waiver of this requirement must be obtained from the Solid Waste Management Section of the Department of Environmental Quality.

(ii) Storage. Sludge storage shall be provided in lined earthen lagoons or structural tanks. The lagoon lining shall be designed to protect the groundwater pursuant to the requirements of Chapter VIII of the Water Quality Divisions rules and regulations. Sludge storage volume shall be sufficiently large to provide for independent operation of the sludge dewatering or disposal facilities from preceding liquid or sludge processes.

Section 21. Disinfection.

(a) Chlorination/dechlorination.

(i) Chlorination. The disinfection capacity shall be sized to provide the coliform concentrations required by the discharge permit. Feeders shall be sized to provide the minimum dosage at the minimum flow rate and to the maximum dosage at the maximum flow rate.

(ii) Dechlorination. Dechlorination feeders shall be sized for the final effluent dechlorination dosage required by the discharge permit requirements.

(iii) Chlorination.

(A) Number of units. Feeders shall be able to supply, at all times, the neces-

sary amounts of chemical at an accurate rate (±3%) throughout the range of feed. The number of units shall provide capacity for effluent disinfection with the largest unit out of service and a separate feeder or feeders for ancillary uses, such as prechlorination or intermediate process control chlorination. The number of feeders shall be selected to permit feeding chemicals over the range of required dosage while only varying a single feeder over a 10:1 range.

(B) Chemical storage. Chlorine shall be stored in a heated, ventilated space. Space shall provide at least 30 days of chemical supply, convenient and efficient handling, and dry conditions. Cylinders or other containers of chlorine gas should be isolated from operating areas and restrained in position to prevent upset.

(C) Piping. Piping systems carrying gaseous or liquid chlorine shall be schedule 80 black steel pipe with forged steel fittings. Bushings shall not be used. Vacuum piping for gaseous chlorine may be polyethylene tubing.

Gas piping between the chlorine pressure reducing valve of the chlorinator and the ejector shall be PVC or polyethyl ene. Piping for aqueous solutions of chlorine beyond the ejector shall be PVC, fiberglass, or steel pipe lined with PVC or saran.

(D) Maximum withdrawal. The maximum withdrawal rate of gaseous chlorine shall be limited to 40 lbs/day (18.1 kg/day) for 100 or 150 lb (45.4 or 68.0 kg) cylinders and 400 lbs/day (181 kg/day) for 2,000 lb (907 kg) cylinders, unless chlorine evaporators are used.

(iv) Dechlorination.

(A) Number of units. Dechlorination equipment shall be provided to permit feeding the design dosage with the largest unit out of service. Feeders shall be sized for a 10:1 feed range.

(B) Chemical storage. Chemical storage shall be in a heated, ventilated room, separate from chlorine cylinder storage. Provisions for heating the storage area or the S0 cylinders shall be provided. Where used, bin storage shall be provided with desiccated vents.

(C) Piping. Piping for liquid or gaseous S0 shall be schedule 80 black steel pipe with forged steel fittings. Bushings shall not be used. Piping for aqueous solutions of dechlorination chemicals shall be PVC, fiber glass, or steel pipe lined with PVC or saran. All valves for liquid and gaseous sulfur dioxide shall be as approved by the Chlorine Institute. Valves for aqueous solution of dechlori nation chemicals shall be PVC or saran lined.

(D) Maximum withdrawal.

(I) The maximum withdrawal rate for sulfur dioxide from 2,000 lb (907 kg) cylinders shall be 200 lb (90.7 kg) per day, unless sulfur dioxide evaporators are used.

(v) Makeup water. Water used for dissolving dry chemicals, diluting liquid chemicals or operating chlorine or S0 injectors shall be chlorinated and strained for filtered (65 mesh) final effluent or potable water. Where potable water is used, backflow prevention shall be achieved by (a) a

6 inch (15.2 cm) air gap between the potable water supply pipe and the maximum water level of a receiving tank; or (b) an approved reduced pressure zone backflow preventer.

(vi) Mixing requirements. The feed point for chlorination or dechlorination chemical shall be at a location of high turbulence. At points of critical flow, specially designed static tube mixers or artificial mixing are required.

(vii) Contact basins.

(A) Detention time. The chlorine contact period shall provide a minimum of 15 minutes contact time at the peak hour design flow. The contact period shall be from the point of chemical injection into the flow to the outfall point or dechlorination feed point.

(B) Baffling. Baffling of the chlorine contact basin shall provide a length-to-width ratio of 5:1 or greater.

(viii) Controls. The minimum control for chlori nation - dechlorination facilities shall include manual variation of feed rate and a portable chlorine residual monitor.

(b) Ozonation.

(i) Applied dosage rates. Ozonation system for disinfection shall provide a range of chemical feed as follows:

Secondary effluents 5-15 mg/L Advanced treatment effluents 5-10 mg/L

(ii) Piping. Injection equipment and piping in contact with ozonated air and air water emulsions shall be of stainless steel, Teflon or other material resistant to ozone. Valves carrying ozonized air shall be made of metal coated with ozone-resistant materials.

(iii) Mixing requirements. Ozone shall be fed to a contact tank along the length of the tank. The ozone contact tank shall be at least 15 feet (4.6 m) deep and provided with vertical serpentine baffles. Fine bubble diffusers shall be used in areas where the flow is downward.

(iv) Detention time. The minimum contact time for ozone is 15 minutes at peak hourly flow. Ozone contact basins shall be covered and provided with means to collect and destroy unreacted ozone. The contact basin shall be designed to facilitate maintenance and cleaning without reducing the effectiveness of the ozonation process.

(c) Housing.

(i) Access. Where housing is specially designed for equipment, structures, rooms and areas contain ing chemical feed equipment used in disinfection, convenient access should be provided. Access to chemical feed rooms shall only be from the outside. Doors shall be provided with panic hardware, and open from the inside to the outside.

(ii) Heating and ventilation. Chemical feed rooms and chemical storage rooms shall

be heated and venti lated. Ventilation shall exhaust continuously from near the floor to an outside area that will not contaminate an air inlet to any building. The exhaust shall be screened and turned downward. Continuous ventilation shall provide a complete air change six times per hour. Emergency exhaust ventilation shall provide a complete room air change 30 times per hour. The control for the emergency ventilation fan shall be on the outside of the room.

(iii) Visual inspection. A clear glass, gas-tight window shall be installed in an exterior door or interior wall of the disinfection chemical feed room.

(iv) Isolation. Chemical feed and storage rooms shall be gas-tight. Ventilation, plumbing and access shall be separated from other building parts. When ton cylinders are used for chlorine or sulfur dioxide storage, storage and feed rooms will be separate. Where powdered or granular chemicals are used, they will be stored in separate rooms from the feed room. Switches for fans and lights shall be outside the room at the entrance. Vents from feeders and storage shall discharge to the outside atmosphere above grade. Pipes and feed lines through interior walls shall be gas-tight.

(d) Safety.

(i) Leak detectors. A bottle of ammonium hydroxide shall be available for chlorine leak detection. For plants that store 1,000 lbs (? 454 kg) or more of chlorine, continuously monitoring leak detectors shall be provided that sound an alarm in the event of an escape of gas.

(ii) Repair kits. Repair kits approved by the Chlorine Institute shall be provided for plants using ton containers or tank cars.

(iii) Personnel equipment. Protective clothing, rubber gloves, and U.S. Bureau of Mines approved industrial canister gas masks shall be provided for each operator who will handle or prepare chemical solutions/mixtures. A respiratory protection program shall be available for all employees.

(iv) Emergency breathing apparatus. Industrial size canister gas masks of the type designed for chlorine gas and approved by U.S. Bureau of Mines shall be available at all installations where chlorine gas is handled. Pressuredemand, selfcontained breathing apparatus shall be provided for repairing leaks to chlorine systems. A respiratory protection program shall be available for all employees.

(v) Instruction manuals. Instruction manuals for all elements of the disinfectant storage, preparation and application system shall be provided. These instruction manuals shall describe each component of the system, and provide a complete discussion of the operation and mainte nance requirements.

Section 22. Effluent Structures.

(a) Location. The location of the effluent discharge shall be at least three miles from public water supply intakes.

(b) Protection from hazards. The outfall sewer shall be constructed and protected against the effects of floodwater, ice, debris, or other hazards as to insure its structural stability and freedom from

stoppage. A manhole should be provided at the shore-end of all gravity sewers extending into the receiving waters.

Section 23. Laboratory requirements.

(a) Test procedures. Test procedures for analysis of monitoring samples shall conform to regulations published pursuant to Section 304(g) of the Federal Water Pollution Control Act (33 U.S.C. 466 et. seq.).

(b) Testing requirements. All treatment plants shall have capability to perform or contract for the self-monitor ing analytical work required by discharge permits or ground water monitoring requirements. All plants shall in addition be capable of performing or contract out the analytical work required to assure good management and control of plant operation and performance. Plants operating under require ments of an industrial pretreatment program must have the capability of performing or must contract out the necessary testing to maintain the program as approved by the reviewing agency.

(c) Minimum requirements.

(i) Location and space. The laboratory shall be located away from vibrating machinery or equipment which might have adverse effects on the performance of laboratory instruments or the analyst and shall be designed to prevent adverse effects from vibration.

A minimum of 400 square feet (37.2 m^2) of floor space shall be provided for the laboratory where an analysis program for a fulltime laboratory chemist is proposed. If more than two persons will be working in the laboratory, 100 square feet (9.3 m^2) of additional space shall be provided for each additional person.

(ii) Materials.

(A) Walls. Provide a durable, impervious surface that is easily cleaned.

(B) Doors. Two exit doors or openings shall be located to permit a straight egress from the laboratory; one exit shall be directly to outside of the building. Panic hardware shall be used. Interior doors shall have glass windows.

(C) Cabinets and bench tops. Cabinet and storage space shall be provided for dustfree storage of instruments and glassware.

Bench top height shall be 36 inches (0.91 m). Tops should be field joined into a continuous surface with acid, alkali, and solvent-resistant cements.

(D) Hoods. Fume hoods shall be provided where reflux or heating of toxic or hazardous materials is required.

(I) Fume hoods.

(1.) Location. A hood shall not be situated near a doorway,

unless a secondary means of egress is provided.

(2.) Fixtures. All switches, electrical outlets, and utility and baffle adjustment handles shall be located outside the hood. Light fixtures shall be explosionproof.

(3.) Exhaust. Twenty-four hour continuous exhaust capability shall be provided. Exhaust fans shall be explosionproof.

(v) Sinks. The laboratory shall have a minimum of two sinks per 400 ft (37.2 m?) (not including cup sinks). Sinks shall be double-well with drainboards and shall be made of epoxy resin or plastic. All water fixtures shall be provided with reduced pressure zone backflow preventers. Traps constructed of glass, plastic, or lead and accessibility for cleaning shall be provided.

(vi) Ventilation and lighting. Laboratories shall be separately air conditioned, with external air supply for 100 percent makeup volume. Separate exhaust ventilation shall be provided. Ventilation outlet locations shall be remote from ventilation inlets.

Lighting shall provide 100 foot-candles at the bench top.

(vii) Gas and vacuum. If gas is required in the laboratory, natural gas shall be supplied. Digester gas shall not be used.

(viii) Water still. Distilled water shall conform to the Standard Methods for the Examination of Water and Wastewater, 15th Edition.

(ix) Emergency shower and eye wash. All laboratories shall be equipped with an emergency eye wash and shower.

(d) Portable testing equipment. Portable testing equipment shall be provided where necessary for operational control testing or industrial waste testing. Portable testing may be used for testing as necessary, provided the testing procedure meets the requirements of Section 304(g) of the Federal Water Pollution Control Act, if the results are to be used for permit reporting. Non-EPA certified proce dures may be used for operational control or gross data generation.

Section 24. Operation and Maintenance Manuals.

(a) Where required. Plant operation and maintenance manuals are required for each new or modified treatment or pumping facility. The manuals shall provide the following information as a minimum:

(i) Introduction.

(ii) Description of facilities and unit processes through the plant from influent structures through effluent structures.

(iii) Plant control system.

(iv) Utilities and systems.

(v) Emergency operation and response.

(vi) Permit requirements and other regulatory requirements.

(vii) Staffing needs.

(viii) Index to manufacturer's manuals.

(b) When required. Draft operation and maintenance manuals shall be submitted to the Department of Environmental Quality at 50 percent completion of construction. Approval of the final operation and maintenance manuals is required prior to plant startup.

(c) Description and facilities. The description of facilities and unit processes shall include the size, capacity, model number (where applicable) and intended loading rate.

(i) Each unit. The manual shall describe each unit, including the function, the controls, the lubrication and maintenance schedule, as well as the following:

(A) Startup operations.

(B) Routine operations.

(C) Abnormal operations.

(D) Emergency or power outage operations.

(E) Bypass procedures.

(F) Safety.

(ii) Flow diagrams. The manual shall provide flow diagrams of the entire process, as well as individual unit processes. The flow diagrams shall show the flow options under the various operational conditions listed above.

(d) Operating parameters. The O&M manual shall provide the design criteria for each unit process. The data shall include the number, type, capacity, sizes, etc., and other information, as applicable.

(e) Troubleshooting guide. Each equipment maintenance manual shall include a section on troubleshooting. These manuals are to be indexed in the plant O&M manual. The troubleshooting guide shall include a telephone number for factory troubleshooting assistance.

(f) Emergency procedures. The plant O&M manual shall detail emergency operations procedures for possible foresee able emergencies, including power outage, equipment failure, development of unsafe conditions, oil and hazardous substances discharge into the plant, and other emergency conditions. The details shall include valve positions, flow control settings, and other information to insure continued operation of the facility at maximum possible efficiency.

The manual shall also detail emergency notification procedures to be followed to protect health and safety under various emergency conditions.

(g) Safety. The manual shall provide general information of safety in and around the plant and its components. Each unit process discussion shall include applicable safety procedures and precautions. For unit processes or operations having extreme hazards (i.e., chlorine, closed tanks, etc.) the discussion shall detail appropriate protection, rescue procedures, and necessary safety equipment.

(h) Compliance submittals. The O&M manual shall summarize the monitoring and the reporting requirements of the discharge permit. These requirements will be modified from time-to-time, and should, therefore, be placed in an appendix to the O&M manual.

(i) Maintenance manuals. Maintenance manuals shall be required for each piece of equipment. These manuals must meet the requirements of the engineer and contractor for installation and startup of equipment. The information included in the manufacturers' manuals shall not be included in the O&M manual.

(i) General content of manuals.

(A) Neatly typewritten table of contents for each volume, arranged in a systematic order.

(B) Product data.

(C) Drawings.

(D) Written text as required to supplement product data for the particular installation.

(E) Copy of each warranty, bond and service contract issued.

(ii) Manuals for equipment and systems.

(A) Description of unit and component parts.

(B) Operating procedures.

(C) Maintenance procedures and schedules.

(D) Service and lubrication schedule.

(E) Sequence of control operation.

(F) Parts list.

(G) Recommended spare parts.

PART C

COMMERCIAL/INDUSTRIAL WASTE AND WASTEWATER FACILITIES

Section 25. General. This part contains the minimum standards for the design and construction of commercial/ industrial wastewater facilities. The applicant shall demonstrate to the administrator that any discharge or seepage from the wastewater facility will not cause a violation of the surface and/ or groundwaters of the state in accordance with Chapter I, "Quality Standards for Wyoming Surface Waters" and Chapter VIII, "Quality Standards for Wyoming Groundwaters." Due to the wide variety of wastes, wastewater and site conditions, the latest available scien tific information shall be used to demonstrate that viola tions will not occur.

Section 26. Discharge to Public Sewerage System. The discharge of commercial/industrial wastewater to a public sewerage system shall be allowed provided a letter of verification from the public sewerage system manager is submitted to the Department of Environmental Quality stating that the municipal system is capable of handling the added organic and/or hydraulic loads. The applicant shall demon strate (1) that the wastewater will not adversely impact the treatment works and/or discharge or (2) that pretreatment of the wastewater shall be provided to eliminate the adverse impacts. The design and construction of any pretreatment device shall reduce the pollutants to the limits imposed by the public sewerage system manager.

Section 27. Domestic Wastes from Commercial/Industrial Facilities. Commercial/industrial facilities which generate waste that is entirely domestic waste shall be designed in compliance with Part B or Part D of Chapter XI. When the commercial/industrial facility generates a combined domestic and commercial/industrial waste, the facility may be designed in compliance with Part B or Part D of this chapter provided the applicant can demonstrate that the commercial/ industrial waste will not interfere or adversely impact the treatment works or the discharge.

Section 28. Biological Treatment Ponds. This section includes the standards for ponds that accept commercial/ industrial waste and wastewater that is primarily organic and utilizes biological organisms for treatment and do not meet the requirements of Section 27. The presence of toxic wastes, hazardous substances, and/or petroleum products shall not interfere or adversely impact the treatment process or disposal system.

(a) Location.

(i) Extraneous surface water and groundwater shall be excluded from entering the wastewater pond or entering the wastewater flow into the pond.

(ii) Ponds shall not be located within the ordinary high water mark of perennial rivers, streams, or creeks; nor in the bottoms of rivers, streams, creeks, draws, coulees, or other natural drainages into which natural runoff may flow and/or enter.

(iii) Ponds shall be protected from structural damage during the 100-year flood event.

(b) Basis of design.

(i) Aerobic, facultative, and anaerobic ponds shall be designed based on the type, strength characteris tics, and anticipated flow rates of the wastewater. Loading rates shall be determined on a case-by-case basis using the best available technology, reference, and/or pilot studies. The affect of any toxic wastes, hazardous substances, and/or petroleum products on the wastewater treatment works and disposal system shall be evaluated. All anaerobic ponds shall be followed by an aerobic process if the system discharges to surface waters of the state.

When seepage is considered part of the design, the potential effect of groundwater mounding on the seepage rate shall be evaluated.

(ii) In addition to the above, all nonsurface water discharging ponds shall be designed on the basis of a water balance that considers net evaporation and seepage. They shall be designed to provide sufficient storage for retention of all wastewater and rainfall during the wettest occurring year of a ten-year period. Seepage shall be controlled to maintain a minimum water depth of two feet in the primary cell during the driest occurring year of a tenyear period.

(c) Pond layout.

(i) Discharging treatment systems and ponds that require liners to protect groundwater shall consist of a minimum of two cells. The largest cell shall not contain more than 55 percent of the total waste volume at the design capacity.

(ii) Inlet structures shall be submerged and located to properly distribute the wastewater flow throughout the pond(s) and shall prevent short circuiting. Influent wastewater shall not erode or disturb the liner, seal, or dike. Submerged multiple inlets are recommended. The pipe shall discharge at least ten feet from the toe of the slope.

(iii) Outlet structures from discharging treatment systems shall be capable of multilevel drawoff and have an overflow device. Outlet structures shall prevent short circuiting, prevent floating debris from discharging, and keep outlet velocities at a minimum so as not to erode or disturb the receiving channel. Erosion control material shall be designed based on flow velocities and quantities. Ice formation shall neither stop the overflow nor damage the outlet structure.

(iv) All pipe protruding through a dike or embankment shall have adequate seepage controls. Capabilities shall exist to drain the ponds for maintenance purposes. By-pass piping for each individual pond cell shall be provided.

(v) A manhole or vented cleanout wye shall be installed prior to the entrance of the influent pipe into the primary pond(s) and shall be located as close to the dike as topography permits. The influent pipe invert should be at least six inches above the maximum operating level of the pond.

(vi) The maximum water depth shall be six feet in the primary cell(s) of non-aerated aerobic or facultative systems. The maximum water depth shall be 15 feet in aerated cells. The maximum water depth for subsequent cells or other types of ponds shall be determined on a case-by-case basis.

The minimum water depth shall be three feet in the primary cell(s) and two feet in subsequent cell(s). Cells designed for high-rate infiltration may be allowed to be dry periodically provided that the applicant can demonstrate that vegetation will be controlled and a regular maintenance program is provided.

(vii) Free board shall be provided to protect embankments and dikes from overtopping from wave action, and shall be a minimum of three feet above the high water level. For ponds less than two acres, two feet of freeboard may be acceptable.

(d) Pond construction.

(i) Soils used in constructing the pond bottom and dike cores (not including the liner) shall be relatively incompressible, have a low permeability, and be free from organic material or trash. The soil shall be compacted at a water content that will insure structural stability, minimize hydraulic seepage, and minimize settling. The soil shall provide an adequate foundation for the liner, if used.

(ii) On ponds that are not specified to receive an artificial liner, no rocks larger than six inches in length shall be permitted in any of the designated embank ment.

On ponds that are specified to be lined with an artificial liner, rocks larger than six inches in length shall not be placed within five feet of the interior slope of any pond embankment. Material containing by volume less than 25 percent of rock larger than six inches and less than 12 inches in length may be placed in the remainder of the embankment.

(iii) Outer dike slopes shall not be steeper than one vertical to two horizontal. Flatter slopes may be required to maintain slope stability. Outer dike slopes shall prevent surface runoff from entering the ponds.

Inner dike slopes shall be sloped between one vertical to four horizontal and one vertical to three horizontal. Flatter inner slopes may be allowed where vegetation due to the shallower slopes will not interfere with treatment or the dike's integrity. Interior slopes surfaced with concrete paving or riprap may be constructed at slopes of one vertical to two horizontal.

(iv) The minimum top dike width shall be eight feet to permit access of maintenance vehicles. Top dikes wider than eight feet shall be required when necessary to assure structural stability.

(v) The pond bottom shall be sufficiently flat to insure a minimum water depth as required in Section 28 (c)(vi).

(e) Dike protection.

(i) Interior embankments shall be protected from wave action with riprap, paving, or other erosion resistant material. The following conditions may be exempted from the riprap require-ments:

(A) Ponds of one surface acre or less;

(B) Ponds with an artificial liner;

(C) Embankments cut into natural slopes when a soil liner is not provided; or

(D) Ponds which are sheltered from wind or where winds are slow enough that significant erosion will not occur.

(ii) Exterior of dikes, top of dikes, and all interior dike surfaces where riprap or a seal is not provided shall be covered with topsoil and seeded with suitable dryland grasses to prevent erosion. A uniform coarse graded gravel may be substituted for the vegetation requirement.

(f) Liners.

(i) Seepage limits. The seepage through the pond bottom and side walls shall not cause a violation of the groundwater standards as described in Chapter VIII (Quality Standards for Wyoming Groundwaters) of the Wyoming Department of Environmental Quality, Water Quality Rules and Regula tions. Liners shall be required if the wastewater charac teristics or site conditions will not insure the protection of the groundwater for which it is classified.

If the applicant cannot document that the facility poses no threat to groundwater and elects not to perform a subsur face study in accordance with Chapter III, Section 15(a) and (b), then the groundwater shall be protected from contamina tion by the wastewater with a liner equivalent to three feet of soil having a permeability of 10-7 cm/sec or less. When an applicant performs a subsurface study, the requirement for the liner shall be determined based on the results of the study and the groundwater protection required. In no instance shall the maximum seepage rate exceed 1/8 inch per day in the primary pond(s).

(ii) Soil and bentonite liners. The specifica tions for a soil or bentonite liner shall be based upon the results of a preliminary testing program and shall contain at a minimum the type of material, optimum and acceptable range in water content, acceptable range for compaction, and maximum allowable particle size.

Soil or bentonite liners used to protect groundwater quality shall meet the following criteria: Written certifi cation that the soil liner was constructed in accordance with specifications shall be provided by a Wyoming registered professional engineer or an independent soils laboratory. Tests for water content and density shall be taken during application of each lift. Additionally, either permeability testing of undisturbed core samples from the in-place seal, or detailed tests such as particle size distribution and Atterburg limits confirming that the soil used in the liner construction was the same soil initially tested, shall be provided. In all cases, at least one test shall be provided per acre per lift, except for core sampling of the in-place liner, where one core of the completed liner shall be tested per acre.

(iii) Synthetic liners. The thickness require ments for synthetic liners shall be determined on a case-bycase basis but shall not be less than 30 mil. The type of liner shall be compatible with the wastewater characteris tics. The synthetic liner shall have a permeability equiva lent to that required in Section 28(f)(i).

Synthetic liners shall be anchored to prevent movement, slippage, and flotation. The synthetic

liner shall be protect ed from degradation by ultraviolet light, ice damage and settling of underdrain trenches. An air venting system may be required beneath the synthetic liner to expel gases trapped during installation, produced by decomposing organic materi al, or produced by a fluctuating water table.

(iv) Uniformity. The pond bottom shall be smooth with a maximum tolerance of ± 6 inches.

(v) Prefilling. All ponds shall be prefilled to the two foot level to protect the liner, to prevent weed growth, to encourage rapid startup of the biological process and discourage odor, to reduce freeze up problems for late fall startups, to confirm the seal's integrity and to maintain the water of the seal at or above optimum condi tions. The raw wastewater shall not be used for prefilling purposes except for anaerobic ponds.

(vi) Exfiltration evaluation. All ponds designated with a maximum exfiltration rate shall be tested for exfiltration. A maximum exfiltration rate not in excess of the design rate shall be deemed acceptable. If the exfiltration rate is deemed excessive, the seal shall be repaired and the test procedure repeated. This procedure shall be repeated until the maximum exfiltration rate criteria is met. Results of all testing shall be submitted to DEQ.

(g) Miscellaneous. A permanent flow measuring device shall be installed at the outfall of discharging pond sitesand shall measure the effluent under all climatic conditions. The accuracy of the flow measuring device must be within ten percent of the actual flow. Ponds with a maximum daily discharge of less than 50,000 gallons per day may be exempted from installing a permanent flow measuring device.

Section 29. Feedlots. This section includes the standards for wastewater retention systems for feedlot runoff. The basic concept of retention systems is to intercept and collect runoff and wastes from the animal feeding area until it can be disposed of via land applica tion. Although retention systems are usually the most economical method of treatment, other systems will be evaluated on a case-by-case basis.

(a) Location.

(i) Groundwater shall be excluded from entering the wastewater pond or the wastewater flow into the pond.

(ii) Ponds shall not be located within the ordinary highwater mark of perennial rivers, streams, or creeks. Ponds not containing hazardous or toxic wastes may be located within the ordinary high water mark of intermit tent rivers, streams, creeks, draws, coulees, or other natural drainages provided a by-pass ditch is installed capable of passing the 24 hour - 100 year precipitation event.

(iii) The wastewater retention system shall be as near to the animal feeding operation as possible to keep construction to a minimum. The retention ponds shall be located outside the pen area for safety and maintenance purposes. Sufficient space must be left between streams or drainage areas to allow construction of the necessary collection ditches and retention ponds.

(b) Basis of design. All livestock confinement areas, alleyways, etc., shall be graded to prevent accumulation of surface waters and to drain all contaminated water to the retention system. Collection ditches shall be provided when necessary to intercept contaminated water. The wastewater retention system shall be designed to contain the 25 year, 24 hour precipitation event. Wastewater in the retention pond
shall be removed and disposed of as soon as possible after a precipitation event. The applicant shall demonstrate that equipment is available for removing the wastewater.

(i) Diversion ditches. The animal feeding area shall be protected with diversion ditches that will direct uncontaminated runoff from areas above and adjacent to the site away from the ponds and shall be capable of diverting the 25-year, 24 hour precipitation event.

(ii) Collection ditches. Collection ditches shall be constructed around the feeding area to intercept the contaminated runoff and transport it to the settling and/or retention pond. The depth shall be adequate to handle the design flow and shall have a bottom slope sufficient to produce a velocity of not less than two feet per second. Side slopes shall not be steeper than eight horizontal to one vertical.

(iii) Settling pond. A settling pond ahead of the retention pond is recommended to accumulate the solids in the waste flow and to simplify their removal and final disposal. The surface area shall be sized to reduce the flow velocity below one foot per second to allow settling of solids. The pond shall be between three to six feet deep to allow sufficient capacity for holding the solids and yet allow easy removal of the solids. The outlet structure shall minimize the overflow of solids into the retention pond.

(iv) Retention pond. The retention pond shall be capable of containing all runoff from the feeding area for the design storm until the contaminated runoff can be disposed. If a settling pond is not provided before the retention pond, the design volume shall be increased by 10 percent to accommodate collection of solids.

(c) Retention pond layout.

(i) The shape and depth shall facilitate ease of cleaning and maintenance. A minimum freeboard of 1.5 feet shall be required above the high water level of the spillway.

(ii) Spillways shall be provided on all retention ponds to pass flows in excess of the 25 year, 24 hour precipitation event. The spillway shall be placed above the design high water level.

(d) Retention pond construction. The retention pond construction shall meet the following requirements:

(i) Soils used in constructing the pond bottom and dike cores (not including the liner) shall be relatively incompressible, have a low permeability, and be free from organic material or trash. The soil shall be compacted at a water content that will insure structural stability, minimize hydraulic seepage, and minimize settling. The soil shall provide an adequate foundation for the liner, if used.

(ii) On ponds that are not specified to receive an artificial liner, no rocks larger than six inches in length shall be permitted in any of the designated embank ments.

On ponds that are specified to be lined with an artificial liner, rocks larger than six inches in length shall not be placed within five feet surface of the interior slope of any pond embankment. Material containing by volume less than 25 percent of rock larger than six inches and less than 12 inches in length may be placed in the remainder of the embankment.

(iii) Outer dike slopes shall not be steeper than one vertical to two horizontal. Flatter slopes may be required to maintain slope stability. Inner dike slopes shall be sloped between one vertical to four horizontal and one vertical to three horizontal. Flatter inner slopes may be allowed where vegetation due to the shallower slopes will not interfere with treatment or the dike's integrity. Interior slopes surfaced with concrete paving or riprap may be constructed at slopes of one vertical to two horizontal.

(iv) The minimum top dike width shall be eight feet to permit access of maintenance vehicles. Top dikes wider than eight feet shall be required when necessary to assure structural stability.

(v) The pond bottom may be sloped to facilitate pumping but shall not exceed a 0.5 percent slope.

(e) Liners.

(i) Seepage limits. The seepage through the pond bottom and side walls shall not cause a violation of the groundwater standards as described in Chapter VIII (Quality Standards for Wyoming Groundwaters) of the Wyoming Department of Environmental Quality, Water Quality Rules and Regula tions. Liners shall be required if the wastewater charac teristics or site conditions will not insure the protection of the groundwater for which it is classified.

If the applicant cannot document that the facility poses no threat to groundwater and elects not to perform a subsur face study in accordance with Chapter III, Section 15(a) and (b), then the groundwater shall be protected from contamina tion by the wastewater with a liner equivalent to three feet of soil having a permeability of 10-7 cm/sec or less. When an applicant performs a subsurface study, the requirement for the liner shall be determined based on the results of the study and the groundwater protection required. In no instance shall the maximum seepage rate exceed 1/8 inch per day in the primary pond(s).

(ii) Soil and bentonite liners. The specifica tions for a soil or bentonite liner shall be based upon the results of a preliminary testing program and shall contain at a minimum the type of material, optimum and acceptable range in water content, acceptable range for compaction, and maximum allowable particle size.

Soil or bentonite liners used to protect groundwater quality shall meet the following criteria: Written certifi cation that the soil liner was constructed in accordance with specifications shall be provided by a Wyoming registered professional engineer or an independent soils laboratory. Tests for water content and density shall be taken during application of each lift. Additionally, either permeabil-

ity testing of undisturbed core samples from the in-place seal, or detailed tests such as particle size distribution and Atterburg limits confirming that the soil used in the liner construction was the same soil initially tested, shall be provided. In all cases, at least one test shall be provided per acre per lift, except for core sampling of the in-place liner, where one core of the completed liner shall be tested per acre.

(iii) Synthetic liners. The thickness require ments for synthetic liners shall be determined on a case-bycase basis but shall not be less than 30 mils. The type of liner shall be compatible with the wastewater characteris tics. The synthetic liner shall have a permeability equiva lent to that of Section 29(e)(i).

Synthetic liners shall be anchored to prevent movement, slippage, and flotation. The synthetic liner shall be protect ed from degradation by ultraviolet light, ice damage and settling of underdrain trenches. An air venting system may be required beneath the synthetic liner to expel gases trapped during installation, produced by decomposing organic materi al, or produced by a fluctuating water table.

(iv) Exfiltration evaluation. All ponds designated with a maximum exfiltration rate shall be tested for exfiltration. A maximum exfiltration rate not in excess of the design rate shall be deemed acceptable. If the exfiltration rate is deemed excessive, the seal shall be repaired, and the test procedure repeated. This procedure shall be repeated until the maximum exfiltration rate criteria is met. Results of all testing shall be submitted to the Department of Environmental Quality.

Section 30. Non-biological Treatment Ponds. This section includes the standards for non-biological treatment ponds or ponds that accept commercial/industrial waste or wastewater that is primarily non-biological in nature and does not utilize biological organisms for treatment. Radio logical affects considered by the Nuclear Regulatory Commis sion (NRC) from non-surface discharging treatment works within a NRC licensed permit boundary are exempt from this section.

(a) Location.

(i) Extraneous surface water and groundwater shall be excluded from entering the wastewater pond or entering the wastewater flow into the pond.

(ii) Ponds shall not be located within the ordinary high water mark of perennial rivers, streams, or creeks. Ponds not containing hazardous or toxic wastes may be located within the ordinary high water mark of intermit tent rivers, streams, creeks, draws, coulees, or other natural drainages provided a by-pass ditch is installed capable of passing the 24 hour - 100 year precipitation event. All other ponds shall be protected from structural damage during the 100-year flood event.

(b) Basis of design.

(i) Ponds shall be designed based on the type of wastewater, the wastewater strength characteristics, and the anticipated flow rates. Loading rates shall be determined on a case-by-case basis using the best available technology, reference, and/or pilot studies. The affect of any toxic wastes, hazardous substances, and/or petroleum products on the wastewater treatment process and disposal system shall be evaluated.

Where seepage is considered part of the design, the potential effect of groundwater mounding on the seepage rate must be evaluated.

(ii) In addition to the above, non-surface water discharging ponds shall be designed on the basis of a water balance that considers net evaporation and seepage. Nondischarging ponds shall be designed to provide sufficient storage to retain all wastewater and rainfall during the wettest occurring year of a ten year period.

(c) Pond layout.

(i) Discharging treatment systems and ponds that require liners to protect groundwater shall consist of a minimum of two cells. The largest cell shall not contain more than 55 percent of the total waste volume at the design capacity.

(ii) Inlet and intracell structures for discharging treatment systems shall prevent short circuiting, and shall not erode or disturb the liner, seal or dike.

(iii) Outlet structures from a discharging treatment system shall have an overflow device, prevent short circuiting, prevent floating debris from discharging, and keep outlet velocities to a minimum so as not to erode or disturb the receiving channel. Erosion control material shall be designed based on flow velocities and quantities. Ice formation shall neither stop the overflow nor damage the outlet structure.

(iv) All pipe protruding through a dike or embankment shall have adequate seepage controls. Capabilities shall exist to drain the ponds for maintenance purposes.

(v) A manhole or vented cleanout wye shall be installed prior to the entrance of the influent pipe into the primary pond(s) and shall be located as close to the dike as topography permits. The influent pipe invert should be at least six inches above the maximum operating level of the pond.

(vi) The maximum and minimum water depth shall be determined on a case-by-case basis. However, the design engineer must demonstrate that ponds with less than two feet water depth will not have vegetation problems.

(vii) Free board shall be provided to protect embankments and dikes from overtopping from wave action, and shall be a minimum of three feet above the high water level. For ponds less than two acres, two feet of freeboard may be acceptable.

(d) Pond construction.

(i) Soils used in constructing the pond bottom and dike cores (not including the liner) shall be relatively incompressible, have a low permeability, and be free from organic material or trash. The soil shall be compacted at a water content that will insure structural stability, minimize hydraulic seepage, and minimize settling. The soil shall provide an adequate foundation for the liner, if used.

(ii) On ponds that are not specified to receive an artificial liner, no rocks larger than

six inches in length shall be permitted in any of the designated embank ment.

On ponds that are specified to be lined with an artifi cial liner, rocks larger than six inches in length shall not be placed within five feet of the interior slope surface of any pond embankment. Material containing by volume less than 25 percent of rock larger than six inches and less than 12 inches in length may be placed in the remainder of the embankment.

(iii) Outer dike slopes shall not be steeper than one vertical to two horizontal. Flatter slopes may be required to maintain slope stability. Outer dike slopes shall prevent surface runoff from entering the ponds.

Inner dike slopes shall be sloped between one vertical to four horizontal and one vertical to three horizontal. Flatter inner slopes may be allowed where vegetation due to the shallower slopes will not interfere with treatment or the dike's integrity. Interior slopes surfaced with concrete paving or riprap may be constructed at slopes of one vertical to two horizontal.

(iv) The minimum top dike width shall be eight feet to permit access of maintenance vehicles. Top dikes wider than eight feet shall be required when necessary to assure structural stability.

(e) Dike protection.

(i) Interior embankments shall be protected from wave action with riprap, paving, or other erosion resistant material. The following conditions may be exempted from the riprap requirements:

(A) Ponds of one surface acre or less;

(B) Ponds with an artificial liner;

(C) Embankments cut into natural slopes where a soil liner is not provided; or

(D) Ponds which are sheltered from wind or where winds are slow enough that significant erosion will not occur.

(ii) Exterior of dikes, top of dikes, and all interior dike surfaces where riprap or a seal is not provided shall be covered with topsoil and seeded with suitable dryland grasses to prevent erosion. A uniform coarse graded gravel may be substituted for the vegetation requirement.

(f) Liners.

(i) Seepage limits. The seepage through the pond bottom and side walls shall not cause, a violation of the groundwater standards as described in Chapter VIII (Quality Standards for Wyoming Groundwaters) of the Wyoming Department of Environmental Quality, Water Quality Rules and Regulations. Liners shall be required if the wastewater characteristics or site conditions will not insure the protection of the groundwater for which it is classified.

If the applicant cannot document that the facility poses no threat to groundwater and elects not to

perform a subsur face study in accordance with Chapter III, Section 15(a) and (b), then the groundwater shall be protected from contamina tion by the wastewater with a liner equivalent to three feet of soil having a permeability of 10-7 cm/sec or less. When an applicant performs a subsurface study, the requirement for the liner shall be determined based on the results of the study and the groundwater protection required. In no instance shall the maximum seepage rate exceed 1/8 inch per day in the primary pond(s).

(ii) Soil and bentonite liners. The specifica tions for a soil or bentonite liner shall be based upon the results of a preliminary testing program and shall contain at a minimum the type of material, optimum and acceptable range in water content, acceptable range for compaction, and maximum allowable particle size.

Soil or bentonite liners used to protect groundwater quality shall meet the following criteria. Written certifica tion that the soil liner was constructed in accordance with specifications shall be provided by a Wyoming registered professional engineer or an independent soils laboratory. Tests for water content and density shall be taken during application of each lift. Additionally, either permeability testing of undisturbed core samples from the in-place seal, or detailed tests such as particle size distribution and Atterburg limits confirming that the soil used in the liner construction was the same soil initially tested, shall be provided. In all cases, at least one test shall be provided per acre per lift, except for core sampling of the in-place liner, where one core of the completed liner shall be tested per acre.

(iii) Synthetic liners. The thickness require ments for synthetic liners shall be determined on a case-bycase basis but shall not be less than 30 mils. The type of liner shall be compatible with the wastewater characteris tics. The synthetic liner shall have a permeability equiva lent to that of Section 30(f)(i).

Synthetic liners shall be anchored to prevent movement, slippage, and flotation. The synthetic liner shall be protect ed from degradation by ultraviolet light, ice damage and settling of underdrain trenches. An air venting system may be required beneath the synthetic liner to expel gases trapped during installation, produced by decomposing organic materi al, or produced by a fluctuating water table.

(iv) Prefilling. For soil or bentonite liners, a method of maintaining the seal at or above optimum moisture conditions is required.

(v) Exfiltration evaluation. All ponds designated with a maximum exfiltration rate shall be tested for exfiltration. A maximum exfiltration rate not in excess of the design rate shall be deemed acceptable. If the exfiltration rate is deemed excessive, the seal shall be repaired and the test procedure repeated. This procedure shall be repeated until the maximum exfiltration rate criteria is met. Results of all testing shall be submitted to the Department of Environmental Quality.

(g) Miscellaneous. A permanent flow measuring device shall be installed at the outfall of discharging pond sites and shall measure the effluent under all climatic conditions. The accuracy of the flow measuring device must be within ten percent of the actual flow. Ponds with a maximum daily discharge of less than 50,000 gallons per day may be exempted from installing a permanent flow measuring device.

Section 31. Sedimentation Control Facilities. This section includes the standards for sedimentation control facilities. Those sedimentation control facilities that are regulated under Water Quality Rules and Regulations, Chapter X, "Performance/Design Standards for Surface Coal Mining Runoff Control Facilities" are exempted from this section.

(a) Location. The sedimentation control facilities shall be as near to the affected lands as possible to keep construction and containment volumes to a minimum. Sedimen tation control facilities shall be located off-channel when possible. Runoff from unaffected lands should be by-passed around the containment area. All affected lands must drain to a sedimentation control facility.

(b) Basis of design. Sedimentation control facilities shall control all runoff from areas which drain into the facility from a 10 - year 24 - hour precipitation event in addition to the estimated sediment storage volume for one year be always available. The pond shall be drained down to the permanent pool level as soon as the effluent meets the discharge parameters. The applicant shall demonstrate that equipment or outlet structures are available for draining the pond.

(c) Layout.

(i) Inlet ditches or structures shall not erode or disturb the pond bottom.

(ii) Outlet structures, if used, shall have an overflow device, prevent short-circuiting, prevent floating debris from discharging and shall not erode or disturb the dike. All pipe protruding through a dike shall have adequate seepage control. The point of discharge into a channel shall be protected against erosion and erosion control devices shall be designed based on flow velocities.

(iii) Spillways. Sedimentation control facilities that individually contain more than 2.0 acre-feet of runoff or that individually have more than 2.0 acres of surface area or that are located on-channel shall have a spillway to by-pass precipitation events in excess of the design event. Spillways shall safely pass the 25 year flood event except when the impoundment height is greater than twenty feet or capacity exceeds twenty acre-feet; in which case the spillway shall safely pass the 100-year flood event.

(iv) By-pass ditches. If by-pass ditches are provided to transport runoff from unaffected lands, they shall be designed to pass the runoff from a 25 year precipi tation event.

(v) Freeboard. Freeboard shall be provided to protect embankments and dikes from overtopping from wave action and shall be a minimum of one foot above the high water level. For ponds less than two acres, one-half foot of freeboard may be acceptable.

(d) Construction.

(i) Soils used in constructing the pond bottom and dike cores shall be relatively incompressible, have a low permeability, and be free from organic material or trash. The soil shall be compacted at a water content that will insure structural stability, minimize hydraulic seepage, and minimize settling.

Rocks larger than six inches in length shall not be placed within five feet of the interior slope

surface of any pond embankment. Material containing by volume less than 25 percent of rock larger than six inches and less than 12 inch in length dimension may be placed in the remainder of the embankment.

(ii) Outer dike slopes shall not be steeper than one vertical to two horizontal. Flatter slopes may be required to maintain slope stability. Inner dike slopes shall be sloped between one vertical to four horizontal and one vertical to three horizontal.

(iii) The minimum top dike width shall be suffi cient to provide structural stability.

(iv) Riprap or other acceptable erosion control shall be installed on the inner dike slopes at all anticipat ed levels of water. Dikes cut into existing ground shall be exempted from riprap requirements. Ponds that have less than 2.0 acres of surface area shall also be exempted.

PART D

SEPTIC TANK AND/OR SOIL ABSORPTION SYSTEMS
AND OTHER SMALL WASTEWATER SYSTEMS

Section 32. General. This part contains the minimum standards for the design and construction of sewerage systems, treatment works and disposal systems for domestic wastes and industrial wastes generated by facilities other than specifically covered by other parts of this Chapter.

Section 33. Definitions Specific to Part D.

(a) "Absorption system" means a system constructed under the surface of the ground which receives and distrib utes effluent from a pretreatment device effectively filter ing the effluent through soil or media.

(b) "Aerobic unit" means a covered, watertight receptacle which receives wastewater. The unit removes settleable solids, floatable material, and a part of soluble organic matter by the use of aerobic biological treatment.

(c) "Building drain" means the building drain is that part of the lowest piping of a drainage system which receives the discharge from soil, waste and other drainage pipes inside the walls of the building and conveys it to the building sewer beginning two feet (.6m) outside the building wall.

(d) "Building sewer" means the building sewer is that part of the horizontal piping of a drainage system which extends from the end of the building drain and conveys the building drain discharge to the septic tank or other onsite sewage disposal facility.

(e) "Domestic sewage" means the liquid- and waterborne wastes derived from the ordinary living processes, free from industrial wastes, and of such character as to permit satisfactory disposal without special treatment.

(f) "Dosing system" means the system of tanks, pumps or syphons, and piping located be-

tween the septic tank and soil absorption system which is intended to apply a large quantity of settled wastewater to the absorption system in a short period of time.

(g) "Hydrogeological study" means a study of the occurrence, distribution, quality and movement of the shallowmost groundwater of the site and the potential impact of wastewaters on the groundwater.

(h) "Impermeable soil" means any soil which has a percolation rate greater than 60 minutes per inch.

(i) "Pump Tank" means a tank in which the dosing pumps or syphons are installed.

Section 34. Design Flows. The sewerage system, treatment works and disposal system shall have a minimum absorption area based on the minimum peak design flows listed in Table 1 below.

Table 1

Quantities of Domestic Sewage Flows

Type of Establishment (gallons per day per ___)	Flow
Residential Units	
Single Family Dwellings	150/bedroom
Multiple Family Dwelling (with laundry capabilities)	150/bedroom
Multiple Family Dwelling (without laundry capabilities)	120/bedroom
Cottages	50/person
Mobile Home Parks	350/home*
Commercial Facilities	
Airports	4/passengers
Bar	3/patron
Bathhouses and swimming pools	10/person
Campgrounds (individual sewer outlets available)	100/site
Campgrounds (service building only)	75/site
Car or truck wash	200/vehicle
Church (no food preparation and/or dishwashing)	5/seat
Church (food preparation and/or dishwashing)	7/seat
Country Club	100/member
Factories	30/employee

Hospital 200/bed
Laundry (self-service) 600/machine or,
50/cycle Motels 80/double bed,
40/single bed
Office building 30/employee
Restaurant (toilet and kitchen wastes) 13/meal

Type of Establishment Flow
(gallons per day per ___)

Restaurant (kitchen wastes) 6/meal
Restaurant (additional for bars and
lounges) 2/meal
Restaurant (kitchen wastes with
disposable service) 2/meal
Rest Home 100/resident
Schools
Boarding 100/resident student
Day, without gyms, cafeterias, or
showers 15/student
Day, with cafeterias only 20/student
Day, with cafeteria, gym and showers 25/student
Service stations 10/vehicle served
Shopping Center 2/parking space
Store, Retail 30/employee
Theaters:
Movie 5/seat
Drive-In 15/vehicle space
Warehouses 30/employee

* Must consider flow into the soil absorption system from mobile homes where taps are allowed to run to prevent freez ing.

Section 35. Isolation.

(a) Domestic wastewater. The isolation distances listed below apply when domestic wastewater is the only wastewater present.

(i) If the flow is less than 2000 gallons per day (gpd), the minimum isolation distance (in feet) shown in Table 2 shall be maintained.

Table 2

	To Septic Tank Or Equivalent	To Absorption From System

Wells (includes neighboring wells)	50	100
Property lines	10	10
Building Foundation (without foundation drains)	5	10
Building Foundation (with foundation drains)	5	25
Potable Water Pipes	25	25
Septic tank		10
Stream or Surface Body of Water (including seasonal and intermittent)	50	50

(ii) If the flow is greater than 2000 gpd but less than 10,000 gpd, the minimum isolation distances (in feet) shown in Table 3 shall be maintained.

Table 3

	To Septic Tank Or Equivalent	To Absorption From System
Wells (includes neighboring wells)	50	200
Property lines	10	10
Building Foundation (without foundation drains)	5	10
Building Foundation (with foundation drains)	5	50
Water Lines	25	50
Septic Tank		10
Stream or Surface Body of Water (including seasonal and intermittent)	50	100

(iii) For systems larger than 10,000 gallons per day, the isolation distance shall be determined by a hydrogeological study in accordance with Section 15(b) of Chapter III, but shall not be less than those in subsection two above.

(b) Non-domestic wastewater. For disposal of wastewaters other than domestic wastewater, the isolation distances required shall be determined from a hydrogeological study in accordance with Section 15(b) of Chapter III.

(c) Location. Absorption systems shall not be located beneath buildings, parking

lots, roadways or other similarly compacted areas.

Section 36. Site Suitability.

(a) Soil exploration. Soil exploration to a minimum depth of four feet below the bottom of the proposed absorp tion system shall be made to provide information on subsoil conditions.

(b) Soil evaluation.

(i) No less than three percolation tests shall be run in the proposed absorption system location. The percolation tests shall be performed in accordance with Appendix A of this part. The type of soil encountered at the percolation test location shall be specified.

(ii) An evaluation of the soil texture by a person experienced in soils classification, may be used to estimate the percolation rate, but at least one percolation test shall be performed.

(c) Groundwater protection and bedrock or impermeable soil separation.

(i) For single family homes, the depth to bedrock or impermeable soil must be at least four feet from the bottom of the absorption system stone and the natural ground surface. The depth to seasonally high groundwater must be at least four feet from the bottom of the absorption system stone and at least two feet from the natural ground surface.

(ii) For all systems other than single family homes up to 2000 gallons per day, the depth to bedrock or impermeable soil must be at least four feet from the natural ground surface. The depth to seasonally high groundwater must be at least four feet from the bottom of the absorption system stone and at least two feet from the natural ground surface. Also, a minimum of three feet of unsaturated soil shall be maintained between the bottom of the absorption system stone and the estimated groundwater mound imposed on the seasonally high groundwater table. The height of the groundwater mound may be estimated from Figures 1 through 6. The average daily flow should be used and may be estimated as 0.6 times the flow determined from Table 1.

(iii) For all systems larger than 2000 gallons per day, a minimum of three feet of unsaturated soil shall be maintained between the bottom of the absorption system stone and the estimated groundwater mound imposed on the seasonally high groundwater table. The maximum height of the groundwa ter mound shall be estimated by the design engineer.

(d) Excessively permeable soils. Soils having a percolation rate of one minute per inch or less are unsuitable for subsurface sewage disposal. These soils may be used if a six inch layer of soil having a percolation rate of five minutes per inch or greater is placed between the leach system stone and the existing soil. The soil absorption system shall be sized based on the percolation rate of the fill material.

(e) Sloping ground installations.

(i) Absorption systems shall not be located in an area where the natural slope is steeper than stated below. The following are the maximum permissible slopes on which an

absorption system may be constructed.

Percolation Rate (min/inch)	Maximum Slope*
Faster than 5	25%
6-45	20%
46-60	15%

* Flatter slopes may be required where the effluent may surface downslope.

(ii) All absorption systems must be located at least 15 feet from the top of any break in slope which exceeds the maximum allowed in subsection (i) above.

Section 37. Building Sewer Pipes.

(a) Building drain pipe. All building drain pipe shall comply with the standards published in the Uniform Plumbing Code-1982 or other locally approved, nationally recognized plumbing code.

(b) Building sewer pipe. All building sewers shall be installed in accordance with the Uniform Plumbing Code - 1982 or other locally approved nationally recognized plumbing code. In the absence of an approved plumbing code, the building sewer shall comply with the following:

(i) Material. Polyvinyl Chloride (PVC), Acrylonitrile - Butadiene - Styrene (ABS), cast or ductile iron, portland cement, or vitrified clay pipe shall be used for sewer pipes. The septic tank inlet and outlet pipes shall be cast or ductile iron or schedule 40 PVC and shall extend past the septic tank excavation to solid ground.

(ii) Size. Building sewer pipes shall not be smaller than four inches in diameter. They shall be sized to handle the peak hourly flow from the building.

(iii) Slope. Building sewer pipes should be laid at a minimum slope of 1/4 inch per foot, but shall not be flatter than 1/8 inch per foot.

(iv) Alignment. Building sewer pipes should be laid in a straight line. Any single change or cumulative change of alignment of 22 1/2 degrees or greater shall be served by a cleanout.

(v) Cleanouts. Cleanouts shall be provided every 100 feet maximum.

(vi) Backfilling. All sewer piping shall be laid on a firm bed throughout its entire length. It shall be protected from damage due to rocks, hard lumps of soil, debris and the like. Special care shall be utilized to prevent lateral movement or ovalation during backfill. The backfill material shall be compacted to a density at least equivalent to the trench walls. Backfill over the pipe shall be of sufficient depth to protect the pipe from expected traffic loads and the wastewater from freezing.

Section 38. Soil Absorption System Sizing.

(a) Trench, bed and seepage pit systems. The total infiltrative surface of a soil absorption system shall be calculated based on the flow rate as determined by the criteria stated in Section 34 and with the allowable loading rate as determined by using Figure 7. The total infiltrative surface is the sum of the sidewall and bottom areas of the absorption system below the invert of the distribution pipe.

(b) Soils with a percolation rate of 60 minutes per inch or greater are unacceptable for standard absorption systems.

Section 39. Pretreatment.

(a) Septic tanks.

(i) Material. The septic tank shall be constructed of durable material not subject to excessive corrosion or decay and structurally capable of supporting the loads to which it will be subjected. The tank shall be water-tight.

(ii) Size.

(A) Residential units serving no more than 4 families. Minimum liquid volume of septic tanks shall be 1000 gallons for residences through four bedroom capacity. Additional capacity of 250 gallons per bedroom shall be provided for each bedroom over four.

(B) Commercial/industrial units. Septic tanks shall have a minimum effective liquid capacity suffi cient to provide at least 36 hour retention at peak flow or 1,000 gallons, whichever is greater.

(iii) Configuration.

(A) The septic tank shall have a length to width ratio of no less than two to one, or be so parti tioned as to provide protection against short circuiting of flow. The water depth shall be no less than four feet nor greater than six feet. The septic tank inlet shall be provided with a tee or baffle. The outlet shall be provided with a tee or baffle that extends into the middle third of the water depth to prevent floating or settled solids from carrying over into the disposal field or bed. The inlet pipe shall be at least three inches higher than the outlet pipe.

(B) If the septic tank is partitioned, the volume of the first compartment must be at least 50 percent of the total required volume. The partition shall allow venting of the tank.

(C) The outlet elevation shall be designed to provide a distance of 20 percent of the liquid depth between the top of the liquid and the bottom of the septic tank cover for scum storage.

(iv) Access. A manway access shall be provided to each compartment of the septic tank for inspection and cleaning. The manway access shall have a minimum opening of 20 inches in the least dimension. Both inlet and outlet devices shall be accessible. A cleanout having a minimum diameter of six inches shall be provided in each tank compartment and shall extend to the ground surface and be capped.

(v) Installation. The septic tank shall be placed on a level grade and a firm bedding to prevent settling.

(b) Aerobic units.

(i) Residential units serving no more than four dwelling units. Aerobic treatment units can be used as a pretreatment device for a single residential unit serving no more than four families provided the unit carries the seal of testing and approval from the National Sanitation Foundation (NSF) for the NSF Standard No. 40 - 1978. The unit shall be sized based on the flow quantities stated in Section 34. No reduction in the sizing of soil absorption systems or the final treatment systems shall be permitted if an aerobic unit is used instead of a septic tank.

(ii) Commercial and residential units serving more than four families. Aerobic units treating wastewater generated from other than a single residential unit serving four families or less shall meet the design requirements of Part B or Part C of Chapter XI.

(c) Interceptors - grease, oil, silt and sand.

(i) When required. Liquid wastes containing grease, oil, or silt and sand shall provide an interceptor before the septic tank. Waste streams from residential living units are exempt from this requirement.

(ii) Material. The interceptor shall meet the material requirements of Section 39 (a)(i).

(iii) Sizing. Interceptors shall be sized using one of the following formulas:

Commercial kitchens (grease, garbage)

Number of meals per	X	Waste* Flow	X	Retention** time	X	Storage*** factor	=	Interceptor size(liquid capacity)
		peak hour rate						

Car wash (sand, silt, oil)

Total washer equipment	X	60	X	Retention time	X	Storage factor	=	Interceptor size(liquid capacity)
				flow rate (GPM)				

Laundries (grease, lint, silt)

Number of machines	X	2 cycles per hour	X	Waste flow	X	Retention time	X	Storage factor	=	Interceptor size(liquid capacity)
										rate

* Waste flow rate - see Table 1.

** Retention Times -

Commercial kitchen waste:	
Dishwasher and/or disposal	2.5 hours
Single service kitchen:	
Single serving with disposal	1.5 hours
Car washers	2.0 hours
Laundries	2.0 hours

***Storage Factors -

Fully equipped commercial kitchen	8 hr. operation: 1	
kitchen	16 hr. operation: 2	
	24 hr. operation: 3	Single service kitchen 1.5
Carwashers	self-serve: 1.5	
	employee operated: 2	Laundries 1.5 (allows for rock filter)

(iv) Configuration. Interceptors shall have a minimum of two compartments with the first compartment having at least 50 percent of the total required volume. Each compartment shall be vented.

(v) Access. The access shall meet the require ments of Section 39(a)(iv).

(vi) Location. Interceptors shall be located so that they are easily accessible for inspection, cleaning, and removal of the collected wastes. Interceptors shall be placed as close as practical to the fixture it serves. The wastewater from fixtures not producing grease, oil, or sand and silt shall bypass the interceptor.

Section 40. Dosing Systems Following Septic Tanks.

(a) Pumping systems for flow up to 2000 gallons per day.

(i) Pump tank. Where only one pump is provided, the pump tank shall have the minimum volume as required in Table 4 below. The tank shall comply with the material requirements for septic tanks. The pump tank shall be vented. The vent shall have a downward turn that terminates at least 12 inches above ground and be provided with a screen. The pump tank shall have an access manhole provided with an opening at least 20 inches in least dimension.

Table 4

Pump Tank Volume (gallons) Required Between

AVERAGE FLOWS (gallons per day	"OFF" & "ON" SWITCH	"ON" & "ALARM" SWITCH	"ALARM" & TANK INLET	RECOMMENDED PUMP CAPACITY (gpm)
0-499	100	50	200	10
500-999	200	100	400	20
1000-1499	300	100	600	30
1500-2000	400	100	800	40

(ii) Pumps.

(A) Sizing. The pump shall have a flow rate of at least ten gallons per minute when installed. The pressure loss (feet of head) of the system can be calculated by adding: the elevation difference between the discharge outlet at the soil absorption system and the low water level in the pump tank; and the friction losses incurred in the pressure transfer
pipe and distribution piping. Table 5 may be used to estimate the head loss of the pipe when pumping ten gallons per minute and using plastic pipe.

Table 5

Diameter (inches)	Head Loss per 100 feet of pipe (in feet)
1	12
1¼	4
1½	2

(B) Installation/removal. The pump shall be installed in the tank so that it can be removed without entering the tank. This can be accomplished by (1) looping the pipe up near the access manhole with a pipe union provided at the top of the loop, (2) using a quick disconnect sliding coupler, or (3) using a pitless adapter. Chains, cable, or piping can be used to lift the pump out of the tank if designed for this loading. Setting the pump on an 8-inch block minimizes the transfer of any solids that may enter the pump tank.

(C) Electrical controls. The electrical control system for the wastewater pump shall consist of a "pump off" switch, a "pump on" switch, and a "high water alarm" switch which shall be located to provide the necessary volumes as stated in Table 4. All electrical controls (pump electrical cord, switches, etc.) shall comply with the National Electrical Code - 1981, Class 1, Group D, Division 1 locations. All openings around the cables or cords entering the tank shall be sealed.

(iii) Pressure transfer pipe. The pressure transfer piping between the tank and the leach system shall be designed to drain after each pump cycle to prevent freez ing. This can be accomplished by either eliminating the check valve at the pump or by providing a weep hole in the pipe in the tank. If the pipe is long, the tank shall be enlarged by the volume of the pipe To accommodate the volume of liquid drained from the pipe.

(b) Syphons. Where automatic syphons are used, they shall be designed to empty the syphon tank in less than 20 minutes. The syphon tank shall be sized in accordance with Section 40(a)(i) above.

(c) For all systems exceeding 2000 gallons per day. The pumping system shall comply with the standards of Part B of Chapter XI.

Section 41. Subsurface Treatment and Disposal Systems.

(a) General requirements.

(i) Replacement area. An area shall be designated and shown on the plans for future installation of a replacement absorption system. If a trench system is used, the replacement area may include the area between the trenches if sufficient spacing has been provided. At least three feet of undisturbed soil shall remain between the existing and replacement trench side walls.

(ii) Protection. Effort shall be made to protect the natural absorptive properties of the soil. Soil absorp tion systems shall not be installed during adverse weather or soil conditions. Rain, severely cold temperatures, or excessively moist soils are considered adverse weather or soil conditions. All smeared or compacted surfaces shall be restored to their original infiltrative conditions prior to placement of the stone.

(iii) Runoff. Surface runoff shall be diverted around or away from all soil absorption systems.

(iv) Stone. Soil absorption system stone shall be sized between 1/2-inch to 2 1/2-inches. At least two inches of stone shall be placed over the distribution pipe, and at least six inches of stone shall be placed under and beside the distribution piping. A minimum of 12 inches of stone shall be placed between a seepage pit wall and structur al liner. The stone shall be free from sand, silt, and clay.

(v) Gravity pipe. All plastic gravity absorption system pipes shall have a minimum diameter of four inches and shall conform to ASTM standard D2729. Piping in all horizontally constructed absorption systems shall be layed with the holes centered around the vertical axis at the bottom of the pipe. All field tile pipe shall be spaced 1/4 inch apart. Piping in horizontally constructed absorption systems shall have a maximum slope of three inches per 100 feet.

(vi) Pressure pipe. All pressure distribution piping shall be designed to withstand the anticipated pres sures with a safety factor of two, provide uniform application of the wastewater, and have non-clogging orifices.

(vii) Distribution box. If a distribution box is used, it shall be installed to provide uniform distribution of the wastewater and shall be placed so that it will not be subject to frost heave.

(viii) Stone cover. A suitable cover such as untreated building paper, filter cloth, or straw shall be placed over the stone prior to backfilling the system.

(ix) Earth cover. A minimum of 12 inches of earth shall be placed over the absorption system stone. The earth shall be permeable soil that will allow aeration of the system and will support the growth of grass. The earth cover shall be graded to insure that water will not pond on the surface.

(x) Levelness. The bottom of soil absorption systems and each segment of a sidehill system shall be level.

(b) Special requirements for seepage pits. If a structural lining is needed to support stone in a seepage pit, it shall be constructed of durable material not subject to excessive corrosion or decay and structurally capable of supporting the loads to which it will be subjected. The lining shall be perforated or otherwise designed to allow the passage of wastewater. Seepage pits shall be separated by a minimum distance equal to 3 times their diameter.

(c) Special requirements for mounded systems.

(i) Sizing.

(A) The infiltrative surface between the stone and the fill material shall be sized based on the flow rate as determined by Section 34 and the allowable loading rate as determined by Figure 7 of Section 38 for the percola tion rate of the fill. The total infiltrative surface is the sum of the sidewall and bottom areas of the stone - soil interface below the distribution pipe.

(B) The interface area between the fill soil and the native soil shall be sized based on the infiltra tion rate of the native soil as determined by Figure 7 of Section 38 but shall not be smaller than a system designed to the requirements of subsection (ii) below.

(ii) Grade. The finished grade shall extend at least three feet horizontally beyond the stone and then be sloped to the parent soil at a grade no steeper than four horizontal to one vertical.

(iii) Fill soil. The fill soil that is placed between the native soil and the stone shall have a minimum percolation rate of five minutes per inch. Topsoil shall be placed over the mound to promote vegetative cover.

(iv) Preparation. All trees, roots, and other organic matter shall be removed from the area to be occupied by the mound.

(d) Special requirements for trench systems. A minimum separation of three feet or a horizontal distance equal to 1.25 times the vertical depth of the trenches, whichever is greater, of undisturbed soil shall be maintained between adjacent trench sidewalls.

(e) Special requirements for serial sidehill trench or bed systems.

(i) Separation. A minimum of three feet of undisturbed soil shall be maintained between adjacent trench or bed side walls.

(ii) Levelness. The bottom of each serial trench or bed system shall be level.

(iii) Overflow. The overflow pipe between serial leach systems shall be set no higher than the mid-point of the upstream distribution pipe. The overflow pipe shall not be perforated.

(f) Special requirement for bed systems. The distribution system piping shall be spaced no more than 10 feet apart.

Section 42. Evapotranspiration Beds.

(a) Sizing. The area of evapotranspiration beds shall be determined using the following formula:

$$AREA = 586 \frac{Q}{PET-P}$$

where:

Area = Area of the evapotranspiration bed at the ground surface in square feet

Q = Average daily sewage flow, gallons per day, (0.6 times the flow deter mined from Table 1)

PET = Potential evapotranspiration rate in inches per year

P = Annual precipitation rate in inches per year.

(b) Construction.

(i) If an impervious barrier is necessary for the protection of groundwater it shall be installed between the evapotranspiration bed and the native soil. It shall be a polyvinyl chloride sheet with a minimum thickness of 20 mils or equivalent. A 3 inch layer of sand shall be placed under and over the liner.

(ii) The bottom 12 inches of the bed shall be filled with clean stone 1/2 - 2 1/2 inches in diameter. (iii) Perforated pipe complying with Section 41(a)(v) shall be placed in the stone.

(iv) Four inches of pea gravel (less than 1/4-inch in diameter) or durable filter cloth shall be placed over the stone.

(v) A 24-inch uniform sand layer in the size range of D50 (0.10mm) shall be placed on top of the pea gravel or filter cloth.

(vi) A six inch layer of sandy topsoil shall be placed on top of the evapotranspiration bed.

(vii) The bed should be vegetated with small shrubs and/or grasses such as fescue, brome, or alfalfa.

(viii) The evapotranspiration bed shall be placed at a depth sufficient to prevent surcharging of the septic tank.

Section 43. Holding Tanks.

(a) Uses. Holding tanks shall not be used for residential systems when other alternative systems are available, except on a temporary, seasonal or intermittent basis, or when used to correct a failed subsurface disposal system when other alternatives are unavailable. Use of holding tanks for new construction is prohibited. Where holding tanks are allowed, they shall be sized on the basis of seven days storage at the flow rate determined from Table 1.

(b) Acceptance. A letter of verification from the local receiving agency, denoting acceptance of the wastewater generated shall be submitted with the plans.

(c) Location. The location and construction of holding tanks shall meet the requirements for septic tanks in Sections 35(a)(i) and Section 39(a)(i) respectively.

(d) Vent. Each holding tank shall be provided with a two inch minimum diameter vent ending in a return elbow above final grade. The vent shall terminate at least 30 feet from any door, window, or fresh air inlet. The vent should be screened.

(e) Alarm. All holding tanks shall be equipped with a high water level alarm. The device shall be an audible alarm or an indoor illuminated alarm. The alarm level shall be placed at 3/4 the depth of the tank.

(f) Pumpout. A six inch pump out pipe which extends to the surface shall be provided. It shall be capped at all times.

Section 44. Privies.

(a) General requirements.

(i) All privies shall be designed and constructed to prevent access by flies and rodents.

(ii) If indoor plumbing is installed, the grey water disposal method shall meet the requirements of Section 34 through 43. The minimum design flow for grey water shall be obtained from Table 1 with a reduction of 33 percent allowed for the elimination of black wastes.

(iii) The privy shall consist of a vault and an outhouse building.

(b) Isolation. The isolation requirements for privies shall comply with Section 35(a)(i) for absorption systems.

(c) Soil exploration. Soil exploration to a minimum depth of 4 feet below the bottom of the proposed vault shall be made to provide information on subsoil condition.

(d) Groundwater and bedrock separation.

(i) The depth to seasonally high groundwater and bedrock or impermeable soil shall be at least four feet from the bottom of an unlined vault.

(ii) The depth to seasonally high groundwater from the bottom of a water tight vault shall be sufficient to prevent floatation of the empty vault.

(e) Sizing. Vaults shall have a minimum capacity of 500 gallons per riser and shall be a minimum of 4.5 feet deep.

(f) Construction.

(i) The vault shall be constructed and installed to resist breakage and damage imposed by frost heave, uplift pressures from a fluctuating water table, loads imposed by the outhouse building and soils, and damage that may be caused by vandalism or rough cleaning procedures. The vault shall be constructed to prevent access by flies.

(ii) Materials used for vault construction shall be resistant to alkali attack, hydrogen sulfide gas, and other corrosive elements associated with decomposing waste.

(iii) A clean-out manhole shall be installed and shall have a minimum opening of 20 inches in the least dimension. The manhole shall be located outside of the outhouse building and be equipped with a tightfitting secure cover.

(iv) The vault shall be ventilated to a point outside and above the outhouse building. The outhouse building shall have a set of vents installed near the floor on two opposite sides of the building and a roof vent that has a rain cap. All vents shall be screened.

(g) Vault additives. No chemical or biological additive shall be placed in the vault that may adversely effect the operation of a sewage treatment facility where the vault waste will ultimately be disposed or that may adversely impact the quality of the groundwater as specified in Chapter VIII, “Quality Standards for Groundwater of Wyoming”.

Section 45. Chemical Toilets.

(a) General requirements. Chemical toilets shall only be used in the containment of body wastes. These require ments apply only to the use of chemical toilets for permanent structures.

(b) Greywater. If indoor plumbing is installed, a separate greywater disposal is required and

shall meet the requirements of Section 34 through 43. The minimum design flows for greywater shall be obtained from Table 1 with a reduction of 33 percent allowed for the elimination of blackwater wastes.

(c) Disposal. All chemical toilet wastes shall be disposed of at an approved wastewater facility. A letter of verification from the receiving agency, denoting acceptance of the wastewater generated shall be submitted with the plans. These wastes shall not be discharged into a soil absorption system.

(d) Construction. Chemical toilets shall be constructed and installed to resist breakage or damage from routine usage. Outdoor chemical toilets shall be adequately stabi lized and secured to prevent overturning. Materials used shall be resistant to the sewage wastes and the chemicals encountered. The holding compartment of the toilet shall be constructed to prevent accessibility to the public and to disease transmitting vectors.

(e) Additives. No chemical or biological additive shall be placed in the toilet that may adversely affect the operation of a sewage treatment facility where the toilet waste will ultimately be disposed or that may adversely impact the quality of the groundwater as specified in Chapter VIII, "Quality Standards for Groundwater of Wyoming."

Section 46. Small Non-discharging Waste Stabilization Ponds.

(a) General requirements.

(i) The use of this section for small nondischarging waste stabilization ponds applies only to those systems defined as small wastewater systems. All other treatment systems shall meet the requirements of Part B or Part C of Chapter XI as applicable.

(ii) Non-discharging waste stabilization ponds shall only be constructed in soils where the percolation rate exceeds 60 minutes per inch and the soil is at least 1 foot thick on both the sides and bottom of the pond. If the 60 minute per inch percolation rate cannot be obtained, a sufficient clay shall be incorporated into the top foot of soil until the 60 minute per inch percolation rate is reached. An impermeable artificial liner of 20 mils in thickness may be substituted.

(b) Isolation. The isolation distances shall meet the requirements for absorption systems as specified in Section 35(a)(i).

(c) Groundwater protection and bedrock or impermeable soil separation.

(i) For single family homes, the depth to seasonally high groundwater shall be at least four feet from the bottom of pond.

(ii) For all "small wastewater systems" other than single family homes, a minimum of three feet of unsatu rated soil shall be maintained between the bottom of the pond and the estimated groundwater mound imposed on the seasonally high groundwater table. The height of the groundwater mound can be estimated from Figures 1-6, Section 36 in conjunction with the average daily sewage flow.

(d) Sizing.

(i) The area of the lagoon shall be calculated based on the following formula:

$$A = \frac{584 \times Q \times 1.3}{(365 \times S) + (E-P)}$$

A = Area of the lagoon at the 5 foot water level in square feet

Q = Average daily sewage flow, gallons per day, (0.6 times the flow determined from Table 1)

S = Soil permeability in inches per day "S" cannot be greater than 0.25 inches per day "S" shall equal zero for an artificial liner or for bedrock

E = Annual evaporation rate in inches per year

P = Annual precipitation rate in inches per year

(ii) A minimum water level of at least two feet shall be maintained in the pond at all times, including start-up.

(iii) A minimum free board of two feet shall be provided between the lowest embankment berm and the maximum water level. The maximum water level shall not be less than five feet.

(e) Construction requirements.

(i) The slopes of the inside dikes shall not be steeper than three horizontal to one vertical nor flatter than four horizontal to one vertical. The slopes of the outside dikes shall not be steeper than three horizontal to one vertical and shall not allow surface runoff to enter the pond.

(ii) All organic material and debris shall be removed from the pond site prior to construction.

(iii) All fill material shall consist of impervious material that is well compacted and free of rocks, frozen soil, or other large material.

(iv) The minimum top width of the dike shall be eight feet.

Section 47. Commercial/Industrial Wastes.

(a) General requirements. Those requirements listed in Section 32 through 43 and 46 that are applicable to the specific commercial/industrial wastewater or combination of commercial/industrial and domestic wastewater shall apply to this section.

(b) Hydrogeologic investigation. If the wastewater is classified as, or determined to be hazardous and/or toxic and/or contain petroleum products, the applicant shall demonstrate to the administrator that any discharge or seepage from the wastewater facility will not cause a violation of the surface and/or groundwaters of the state in accordance with Chapter I, "Quality Standards for Wyoming Surface Waters" and Chapter VIII, "Quality Standards for Wyoming Groundwaters." Due to the wide variety of wastes, wastewater and site conditions, the latest available scientific informa tion shall be used to demonstrate that violation will not occur.

(c) Impact. If the impact of the hazardous and/or toxic substance and/or petroleum products cannot be determined and mitigated, disposal of the wastewater using a soil absorption system shall be prohibited.

(d) Pre-treatment. Pre-treatment of the wastewater to remove the hazardous and/or toxic substance(s) and/or petroleum products shall be required prior to disposal if deemed necessary to protect the groundwater of the state.

APPENDIX A

Percolation Test Procedure

(a) Location. The percolation test holes shall be spaced uniformly over the proposed absorption field site. A minimum of three test holes are required.

(b) Preparation. A 4 inch to 12 inch hole shall be dug or bored to the proposed depth of the absorption field. The walls shall be vertical. To expose a natural soil surface, the sides and bottom shall be scraped with a sharp pointed instrument and the loose material shall be removed from the hole. Coarse sand or gravel shall be placed in the bottom of the hole to prevent it from scouring and sealing.

(c) Presoaking. The purpose of presoaking is to have the water conditions in the soil reach a stable condition similar to that which exists during continual wastewater application. The minimum time of presoaking varies with soil conditions but must be sufficiently long so that the water seeps away at a constant rate. The following presoaking instructions are usually sufficient to obtain a constant rate.

(i) In sandy soils, place 12 inches of water in the hole and allow it to seep away. Fill the hole again with 12 inches of water and if the water seeps away in ten minutes or less, it indicates that the soil is excessively permeable and requirements in Section 36(d) of these regulations shall be followed. If the water remains after ten minutes, additional saturation is necessary. Refer to Appendix A(c)(ii) below.

(ii) In other soils, maintain 12 inches of water in the hole for at least four hours. After the four hours of water contact, allow the soil to swell for 12 hours before starting the percolation rate measurement as stated in Appendix A (d) below.

(d) Percolation rate measurement. The water level should be adjusted to six inches above the gravel initially and after each time interval measurement when necessary.

(i) In other soils, establish a fixed reference point and measure the drop in water level at constant intervals. The water level drop should be measured to the nearest 1/8 of an inch. The test may be terminated when the water drop is consistent for three consecutive measurements.

(ii) The percolation rate for each hole is calculated as follows:

Time Interval (Minutes) = Percolation Rate Final Water Level Drop (inches) (minutes/inch)

If only three to five percolation tests are performed, the design percolation rate for the absorption system is the slowest rate from all the holes tested. If six or more percolation tests are performed, the design percolation rate for the absorption system is the average of all the holes tested as determined by the above formula.

PART E

WASTE AND WASTEWATER LAND APPLICATION FACILITIES

Section 48. General. This part contains the minimum standards for the design and construction of waste and wastewater land application facilities.

Section 49. Definitions Specific to Part E.

(a) "Direct consumption" or "direct food chain crops" means vegetable, grain or fruit crops grown for direct human consumption.

(b) "Indirect food chain crops" means forage or grain crops utilized by grazing animals and thereby one step removed from human consumption.

(c) "Land application/treatment" is the application of wastes or wastewater to the land at a predetermined rate for the purpose of renovation by any or all of the following processes: chemical and microbial degradation, plant uptake and assimilation, or soil adsorption and accumulation in the profile.

(d) "Overland flow land application system" is a system in which treatment is accomplished by the application of wastewater to a sloping, largely impermeable site. Treatment mechanisms include filtration, sedimentation, microbial oxidation, and crop uptake. Typical application rates range from 0.0392-0.3136 yd3/yd @ hr.

(e) "Primary treatment level" (as related to pathogenic organism reduction) is that level of fecal coliform reduction (a minimum of 25 percent reduction) achieveable by primary sedimentation in single cell discharging lagoons operated within the limits described in Part B, Section 13(c).

(f) "Rapid infiltration system" is a land application system in which treatment is accomplished by the percolation of large quantities of wastewater through a sufficient depth of coarse or highly permeable soil profile. Treatment is accomplished by filtration, microbial oxidation (which may include nitrification denitrification), and soil adsorption. Application rates for these systems generally

exceed four inches per week, and may exceed 100 inches per week on soils capable of transmitting a range of .30 to 20 inches of water per hour through the most restrictive layer.

(g) "Slow rate land application system" is an irrigation system in which wastewater treatment is achieved chiefly by microbial oxidation (nitrification - denitrification), plant uptake of nutrients and adsorption on soil and organic matter. Application rates for systems in this category range from 0.5-4 inches per week on soils capable of transmitting 0.06-6.0 inches of water per hour through the most restric tive layer.

(h) "Sludge" means any mixture or suspension of liquid and solid wastes having a total suspended solids content greater than ten percent by weight.

(i) "Soil" is the collection of natural bodies occupying parts of the earth's surface that support plants and that have properties due to the integrated effect of climate and living matter acting upon parent material, as conditioned by relief, over periods of time.

Section 50. Site Requirements.

(a) The method for determining the size of a particular land site for accomplishing the treatment level necessary to comply with an NPDES permit or to maintain a groundwater aquifer within its present class shall be based on the number of acres (hectares) required to reduce the waste constituent identified as requiring the largest land area, based on soil assimilative capacity. The ratio used for this determination is expressed as:

Required Land Treatment Area = G/C

Where:

G = generation rate = the yearly amount
of the controlling constitutent to be applied for land treatment. G is listed in kilograms per year (kg/yr) or pounds per year (lbs/yr).

C = plant-soil assimilative capacity =
the yearly amount of the control ling constituent which can be assim ilated by plant uptake, soil ad sorption and accumulation, transfor mation or degradation, and allow survival and maintenance of indige nous or crop plant species. C is listed in kilograms per hectare per year (kg/ha/yr) or pounds per acre per year (lbs/ac/yr).

Wastewater constituents or categories of constituents from which the land-limiting factor will be selected are generally grouped as:

Organics	Nitrogen
Phosphorus	Heavy metals
Salts, acids and bases	Water

Oil and grease

(b) Slope. Slow rate irrigation systems (generally less than 4.0 inches/wk application rate) will not be developed on slopes greater than 15 percent unless the site is terraced, gated pipe is placed on the contour, or vegeta tion, application rate and soil infiltration rate are such that runoff and erosion would not result.

Overland flow systems will not be developed on sites having less than two percent or greater than eight percent slope.

(c) Soil profile. The minimum depth of unsaturated soil strata on which a land treatment system may be developed is five feet for a slowrate system and ten feet for a rapid infiltration system, unless underdrains or pumped recovery wells are employed for lowering the water table. The appli cant should refer to Part A, Section 5 for innovative technology permit requirements.

(d) Runoff and erosion. All land treatment sites will be protected from upslope runoff by diversion ditches capable of intercepting the overland flow from a 10 - year 24 - hour storm event, unless it is otherwise demonstrated that a storm of this size will not have an impact on the site. A runoff collection ditch is required at the base of overland flow slopes or on sloping irrigation sites where site conditions are such that overapplication of wastewater and/or seasonal precipitation events may threaten to pollute surface waters of the state. Provisions for storage, return and reapplica tion are required where a runoff collection ditch is re quired.

Section 51. Pretreatment Water Quality Requirement. Pretreatment of wastewater shall provide sufficient organic
and inorganic solids reduction, maintaining the estimated infiltration rate of the soil surface.

Section 52. Disinfection and Pathogen Control. Waste water effluent containing pathogenic organisms to be sprayed on agricultural lands supporting indirect food chain crops must achieve fecal coliform limits of 1000 colonies/100 ml (30 day geometric mean) before spray irrigation.

Wastewater containing pathogenic organisms that is surface applied to agricultural lands supporting indirect food chain crops must achieve a fecal coliform reduction equivalent to the primary treatment level (see Section 2(e)).

Wastewater effluent containing pathogenic organisms that is to be used for surface or spray irrigation of direct human consumption crops or for irrigation of golf courses, highway rest areas and rights-of-way (R.O.W.s), parks, playgrounds or similar domestic, commercial and industrial zones must achieve fecal coliform limits of 200/100 ml by positive disinfection.

Section 53. Buffer Zone. A buffer strip of varying width is required around all land treatment sites located within one-fourth mile upwind of current residential, commercial or industrial develop-ment where wastewater containing pathogenic organisms or capable of producing odors is to be spray irrigated. A 100 foot buffer zone is required for the spray irrigation of secondary municipal effluent. A 150 foot buffer zone is required around sites sprayed with primary municipal effluent.

The minimum allowable buffer strip for spray irrigation of wastewaters not containing pathogenic organisms or odorproducing substances is 30 feet.

Section 54. Land Application of Municipal Sewage Sludge and Septic Tank Pumpings. Before municipal sewage sludge and septic tank pumpings can be applied to soils, minimum public health criteria must be met with respect to reduction of pathogenic organisms, limitation of PCBs, and limitation of cadmium and other heavy metals.

(a) Reduction of pathogens. Sludges applied to a land surface or soil incorporated must undergo a Process to Significantly Reduce Pathogens (PSRP) before application.

PSRPs may include, but not be limited to, any one of the following:

(i) Anaerobic digestion - with a solids retention time (SRT) of eight to ten days at 95@F(35@C).

(ii) Aerobic digestion - minimum volatile solids reduction of 40 percent by any combination of time and temperature in the digester resulting in 475 degree days stabilization. (A minimum digester liquid temperature is approximately 40@F (4.4@C) resulting in a maximum winter retention of 108 days).

(iii) Windrow Composting - maintenance of pile temperatures at 131@F (55@C) for two days or 140@F(60@C) for .5 days to achieve approximately a 15 log reduction of the f2 bacteriophage, as monitored at the coldest pile location.

(iv) Individual static or extended aerated pile composting - according to the design developed by researchers at Beltsville, Md. A standard for destruction of pathogens is the maintenance of pile temperatures at approximately 68@C (154@F) for 10 days followed by storage in a curing pile for 30 days.

(v) Lime stabilization - addition of sufficient quantities of lime to maintain the pH at 12 for two hours.

(vi) Chlorine oxidation - the required chlorine is dependent on the type of sludge and percent solids, as follows:

Chlorine Requirement		
Type of Sludge	percent SS	lb/1000 gal
Primary Sludge	4.0	17
Waste-activated sludge with prior primary treatment	0.7	7
no primary treatment	0.7	7
from contact stabilization	0.7	7
Sludge from low and high rate trickling filters	1.0	10
Digester supernatant	0.3	2-10
Septage	1.2	6

From: R.C. Neal of BIF
1 lb/1,000 gal = 0.12 kg/l

In addition, public access to the site must be restricted for 12 months and access by grazing animals restricted for one month. If crops for direct human consumption are grown within 18 months after the application, the sludge must not come into direct contact with the edible portion of the crop.

Septic tank pumpings that are to be land applied must undergo a PSRP unless public access to the site is restricted for 12 months and grazing animal access is restricted for one month.

Where sludge or septic tank pumpings do come into direct contact with the edible portion of a direct consumption crop, or where dried sludge (greater than 40 percent solids) is utilized on parks, golf courses, highway R.O.W.s, or made available to the general public, the sludge or septage must undergo a Process to Further Reduce Pathogens (PFRP).

Disclaimer: Sludge or septage that has been subjected to a PFRP is considered to have an insignificant pathogenic organism content; such sludge is not, however, considered to be 100 percent pathogen free.

PFRPs may include, but not be limited to, any one of the following:

(i) Composting - storage for three months following windrowing, pile composting, or any previously mentioned PSRP.

(ii) Heat drying - use of a flash or rotary kiln drier.

(iii) Pasteurization - at 158@F (70@C) for 30 minutes.

(iv) Lime conditioning - of stabilized sludge to pH of 10.2-11.

(v) Gamma ray irradiation - 400 krads or greater dosage with Ce-137 or Co-60 source for dried, composted sludge of approximately 80 percent solids.

(vi) Electron beam (beta irradiation) - 400 krads dosage for liquid digested sludge.

(b) PCBs (Polychlorinated Biphenyls). Sludges containing greater than 10 mg/kg of PCBs that are land applied where a crop is grown for animal feed or pasture must be soil incorporated unless the annual application is less than 0.4 lbs/acre.

(c) Cadmium and other heavy metals.

(i) Sludges containing a significant quantity (greater than 2 mg/kg) of cadmium may be applied to land where direct human consumption crops are grown if the background soil pH is 6.5 or greater and the sludge pH is 6.2 or greater.

(ii) The maximum annual cadmium application rate to land where any direct human consumption crops are grown must not exceed 0.5 kg/ha (0.44 lbs/acre).

(iii) In addition, maximum cumulative cadmium application to any given land site where direct food chain crops are grown or capable of being grown shall not exceed 5 kg/ha (4.4 lb/ac) for a soil with cation exchange capacity less than 5 meq/100 g, 10 kg/ha (8.9 lbs/ac) for a soil with a cation exchange capacity of 5-15 meq/100 g and 20 kg/ha (17.8 lbs/ac) when the cation exchange capacity is greater than 15 meq/100 g. Maximum cumulative loadings of other metals based on soil cation exchange capacity are as follows:

Soil Cation Exchange Capacity
(meq/100 gms)

	<5	5-10	>15	Metal	lbs/acre
Lead	500	1000	2000		
Zinc	250	500	1000		
Copper	125	250	500		
Nickel	50	100	200		

(iv) Where the background soil pH is less than 6.5 and is adjusted by amendment (e.g. limestone) above that level, the following requirements must be met:

(A) Only indirect food chain crops (animal feed) may be grown, or

(B) Soil pH must be maintained at 6.5 or greater when sludge is applied or when the direct consumption crop is planted.

(C) The metal application rates in Section 54 (c) (i)-(iii) apply.

(v) Where the background soil pH is less than 6.5 and no adjustment is planned, the following requirements must be met:

(A) Only indirect food chain crops (animal feed) may be grown.

(B) The annual cadmium application rate shall not exceed 0.5 kg/ha (0.44 lbs/ac).

(C) The maximum cumulative cadmium application shall not exceed 5 kg/ha (4.4 lbs/ac).

(D) Maximum cumulative applications of lead, zinc, copper and nickel shall not exceed 500, 250, 125 and 50 lbs/acre respectively, regardless of the cation exchange capacity of the soil.

(d) Site limitations.

(i) Sludge and septage must not be applied to sites with a slope greater than five percent whether or not it is soil incorporated, unless the site is protected by a runoff collection ditch, in which case the site slope must not exceed eight percent. Sludge or septage application to frozen or snow-covered ground will require the installation of a runoff collection ditch on slopes greater than three percent.

(ii) Sludge application sites must be located a minimum distance of 300 feet from the definable high water line of all surface water bodies unless the sludge is subsurface injected, in which case the above distance is reduced to 50 feet.

(iii) Sludge application sites must be located a minimum distance of 300 feet from any public water supply wells, whether surface applied or subsurface injected.

(iv) Sludge application sites must be located a minimum distance of 1500 feet from residential developments, unless the sludge is subsurface injected, in which case the above distance reduces to 300 feet.

(v) Sludge application sites must be located a minimum distance of 300 feet from nonresidential developments or public road R.O.W.s, unless the sludge is subsurface injected, in which case the above distance reduces to 50 feet.

Section 55. Irrigation Water Quality.

(a) The surface infiltration rate and hydraulic conductivity of the soil profile shall be approximated by the appropriate tests and used in determining an average annual application rate.

(b) Indigenous or crop plant species shall be capable of survival and maintenance under the conditions of increased soil moisture, salinity, and alkalinity, the classes of which will be determined by use of Figure 1, Tables 1-3 and a soil textural analysis. Waste and wastewater analyses required for this evaluation include electrical conductivity (EC in umhos/cm @ 25@C), sodium (Na+), calcium (Ca2+), magnesium (Mg2+), bicarbonate (HCO3), chloride (Cl-), sulfate (SO42-), Boron (B) and Selenium (Se), and calculation of the Sodium Adsorption Ratio (SAR) by use of the formula:

$$SAR = \frac{[Na+]}{\frac{[Ca2+] + [Mg2+]}{2}}$$

(c) Numerical water quality criteria for special situations.

(i) For continuous and unrestricted irrigation of direct consumption crops or of parks, playgrounds, highway rest areas and rights-of-way (R.O.W.s), or domestic, commer cial and industrial grounds with treated municipal wastewater effluent, the following quality criteria shall not be exceeded:
(ii)For disposal of limited volumes of industrial wastewater and sludge of less than 10 percent solids, the following criteria shall not be exceeded:

pH	4.5 - 9.0 s.u.

BOD	10.0 mg/l Daytime
BOD	30 mg/l Dusk-Dawn
TSS	5.0 mg/l Daytime
TSS	100 mg/l Dusk-Dawn
Fecal Coliforms	200/100 ml
	(positive disinfection) TDS
480.0 mg/l	
Electrical Condutivity, (EC)	750 micromhos/cm@25@C
Sodium Adsorption Ratio (SAR)	10
Chlorides (Cl-)	213 mg/l
Sulfates (SO42-)	192 mg/l
Bicarbonates (HO3-)	Not greater than 50
percent of the total anion concentration in meg/l	
Aluminum (Al)	5.0 mg/l
Arsenic (As)	1.0 mg/l
Beryllium (Be)	0.1 mg/l
Boron (B)	0.6 mg/l
Cadmium (Cd)	0.01 mg/l
Cobalt (Co)	0.5 mg/l
Chromium (Cr)	0.1 mg/l
Copper (cu)	0.2 mg/l
Iron (Fe)	5.0 mg/l
Lead (Pb)	5.0 mg/l
Lithium (Li)	0.1 mg/l
Manganese (Mn)	10.0 mg/l
Nickel (Ni)	0.2 mg/l
Selenium (Se)	0.1 mg/l
Vanadium (V)	0.1 mg/l
Zinc (Zn)	2.0 mg/l

(ii) For disposal of limited volumes of indus trial wastewater and sludge of less than 10 percent solids, the following critieria shall not be exceeded:

pH	4.5 - 9.0 s.u.
Electrical Conductivity (EC)	3,250 micromhos/cm@25@C
Total Dissolved Solids	2,100 mg/l
Sodium Adsorption Ratio (SAR)	26
Potassium	In combination with
sodium, will not produce an SAR greater than 26	
Chlorides (Cl-)	1,500 mg/l
Sulfates (SO42-)	960 mg/l
Bicarbonates (HCO3-)	Not greater than
50 per	cent of the total
anion	concentration,
meq/l	
Arsenic (as H3AsO4,	
Arsenious Acid	0.1 mg/l

Boron (as H3BO3, Boric Acid) 2.0 mg/l
Chromium (Cr) 1.0 mg/l
Copper (Cu) 1.0 mg/l
Nickel (Ni) 0.2 mg/l
Selenium (Se) 0.2 mg/l
Zinc (Zn) 2.0 mg/l
Oil and grease 20,000 lbs/ac when soil
incorporated (surface 6 inches) 2,000 lbs/ac when surface applied

(iii) All other continuous disposal land application systems will be approved on a site-specific, case by case basis by use of the applicable standards and guidelines.

Section 56. Effluent Quality.

(a) Surface water protection. Discharge from a land treatment system to a surface water body will be regulated by the NPDES permit process.

(b) Groundwater protection. Percolation water from land treatment of waste or wastewater shall not degrade groundwater quality to the point at which it is no longer suitable for its current or potential use as described in Chapter VIII of the Wyoming Water Quality Regulations.

PART F

MOBILE HOME PARK AND CAMPGROUND SEWERAGE AND PUBLIC WATER SUPPLY DISTRIBUTION SYSTEMS

Section 57. General. This part contains the minimum standards for the design and construction of mobile home park and/or campground wastewater facilities and public water supply systems.

Section 58. Sewage System Standards.

(a) If sewerage system services are to be provided by a second person, a letter of verification from the system manager stating that they are capable of handling added organic and/or hydraulic loads shall be provided by the owner/operator of the system.

(b) A mobile home park or campground sewerage system, treatment works and disposal system shall comply with Part A, B, C, and/or D of Chapter XI except as follows:

(i) Mobile home park sewerage systems, treatment works and disposal systems shall be designed on the basis of not less than 350 gallons per site per day. Camp ground sewerage systems, treatment works and disposal systems shall be designed on the basis of not less than 100 gallons per site per day for all sewered sites or 75 gallons per site per day for all unsewered sites.

(ii) Sanitary sewers shall not be smaller than six inches in diameter. They shall be installed at a slope equal to or greater than 0.6 feet per 100 feet.

(iii) Not more than two mobile homes or campground sites shall be served by a sanitary sewer service connection pipe of a least four inches in diameter, provided the main branch of the service pipe is served by a cleanout and provided it is not longer than 50 feet. It shall be installed at a minimum slope of 1/4 inch per foot. The riser portion of the service connection pipe shall be constructed of cast iron or schedule 40 plastic pipe. The riser shall be terminated at least four inches above finished grade and shall not be located closer than five feet from a potable water service riser. The service connection pipe shall connect to the sewerage system at a maximum 45 degree bend in the direction of sewage flow.

(iv) Not more than one mobile home shall be served by a sanitary sewer service riser pipe. The riser shall be located so as to minimize the length of pipe required to connect the mobile home drain. The riser pipe shall be capped or plugged when not in use.

(v) The connection of the mobile home drain to the riser pipe shall be sealed.

(vi) If sewer service is provided to sites in a campground, the sanitary sewer service connection pipe shall comply with subsections (iii) and (iv) above.

(vii) Service connection pipes for campgrounds shall be trapped below the frost line.

Section 59. Potable Water Supply Standards.

(a) The potable water distribution system serving any building, mobile home lot, campground site or other appurte nance within a mobile home park or campground which is connected to a public water supply shall be considered an extension or modification of the public supply.

(b) If water is to be obtained from a public water supply, a letter of verification shall be provided from the public water supply system manager stating that the required flow can be supplied at a minimum pressure of 20 pounds per square inch under all conditions of flow throughout the proposed distribution system . A normal working pressure of 35 pounds per square inch shall be maintained in the distri bution system.

(c) The public water supply serving mobile home sites, buildings and other facilities within a mobile home park shall be designed, constructed or installed and protected in accordance with Chapter XII of the Water Quality Rules and Regulations, except as follows:

(i) The water supply source shall be capable of supplying the peak water demand to

a mobile home park distribution system according to the following table:

Homes	Gallons per Minute
25	65
50	105
75	145
100	180
150	235
each additional mobile home over 200	1 gpm

(ii) If fire protection is provided, the flow required shall be in addition to the requirements of subsec tion (i) above.

(iii) Each mobile home shall be provided with a potable water service connection pipe. It shall be 3/4 inch nominal pipe size or larger. The riser portion of the pipe shall be constructed of type K copper or steel pipe from a point below the frost line to the point of connection to the mobile home piping. The riser shall terminate at least four inches above finished grade and shall be protected from damage. The service connection pipe shall be provided with a curb stop below frost penetration. A stop and waste valve with a weep hole below grade shall not be used.

(iv) The distribution system shall be of sufficient size to supply the required volume of water at a minimum pressure of 20 pounds per square inch under all conditions of demand. A working pressure of 35 pounds per square inch shall be maintained under average day demand conditions.

The distribution system mains shall not be smaller than 1 1/2 inches in diameter. If fire protection is provided, the distribution system shall meet the requirements of Chapter XII of the Water Quality Rules and Regulations.

(v) If the potable water is pumped to the distribution system from wells or storage facilities, the pumps shall be capable of meeting the maximum day demand with the largest pumping unit out of service.

(vi) Water storage facilities shall be provided when the potable water source cannot meet the peak demand.

(d) The public water supply serving campground sites, buildings and/or other facilities within a campground shall be designed, constructed and protected in accordance with Chapter XII of the Water Quality Rules and Regulations except as follows:

(i) The public water supply source shall be capable of supplying water to a campground distribution system at a rate of 0.5 gpm/site.

(ii) Below ground stop and waste valves with weep holes below ground shall not be permitted.

(iii) A minimum pressure of 20 pounds per square inch shall be maintained throughout the distribution system under all conditions of flow. A working pressure of 35 pounds per square inch shall be maintained under average day demand conditions.

(iv) The distribution piping shall not be smaller than one inch in diameter. Service pipes shall not be smaller than 1/2 inch in diameter.

PART G

WELL CONSTRUCTION

Section 60. General Information. This part contains minimum standards for design and construction and for the abandonment of wells covered by this part. The applicant or permittee shall provide for design and construction to protect groundwaters of the state in accordance with the water quality standards contained in Chapter VIII, Water Quality Rules and Regulations.

All American Society for Testing of Materials (ASTM), American Water Works Association (AWWA) and American Petro leum Institute (API) specifications listed are intended to mean the latest revision.

Section 61. Definitions Specific to Part G.

(a) "Abandoned well" means a well regulated under this part for which use has been discontinued for more than one year and the owner does not desire to maintain this well for future use; or its use has been permanently discontinued or is in such a state of disrepair that it cannot be used for its intended purpose.

(b) "Annular space" means the space between the well casing and the wall of the drilled hole or between two well casings.

(c) "Artificial recharge well" means well constructed to introduce water into the ground as a means of replenishing groundwater basins.

(d) "Commercial, municipal and industrial waste well" means well constructed to dispose of unusable waste or contaminated water resulting from a commercial activity, municipal collection, storage or treatment facility or an industrial activity.

(e) "Conductor casing" means a tubular retaining structure installed in the upper portion of a well between the wall of the drilled hole and the inner well casing.

(f) "Confining formation" means an impermeable bed or a bed of distinctly lower permeability than the adjacent material in which groundwater may be moving.

(g) "Destroyed well" means a well that has been properly filled so that it cannot produce water nor act as a vertical conduit for the movement of groundwater.

(h) “Geothermal well” means a well constructed to extract or return water to the ground after it has been used for heating or cooling purposes.

(i) “Key seating” means a stuck drill pipe or casing caused by an abrupt change in direction or dogleg in the drilled hole.

(j) “Miscellaneous discharge well” means a well constructed for a special process discharge of limited time and scope.

(k) “Observation and monitor well” means a well constructed for the purpose of observing or monitoring groundwa ter conditions.

(l) “Production casing” means a tubular retaining structure installed in the upper portion of a well between the wall of the drilled hole and the inner well casing.

(m) “Sounding tube” means the access to the well casing that allows the water level in the well to be periodi cally determined. All sounding tubes should have a screw cap.

(n) “Special process discharge well” means a well constructed for the use of a subsurface discharge for recovering a product or fluid at the surface. Special process discharges are defined in detail in Chapter IX, Wyoming Water Quality Rules and Regulations.

(o) “Test well” means a well constructed for obtaining information needed to design a well prior to its construction. Test wells are cased and could be converted to observation or monitoring wells.

(p) “Watertight” means impermeable to water except when under such pressure that structural discontinuity is produced.

Section 62. Application. These standards shall apply to the types of wells listed below. Before a change of use for an existing well can occur, construction standards contained in this part shall be met for the new use.

(a) Well type list requiring permits under Water Quality Rules and Regulations.

(i) Commercial, municipal and industrial waste wells.

(ii) Special process discharge wells.

(iii) Artificial recharge and miscellaneous discharge wells.

(iv) Geothermal wells.

(v) Observation and monitoring wells.

(vi) Test wells.

(b) Standards concerning construction, maintenance and operation of oil or gas producing,

storage, injection or disposal wells are administered by the Oil and Gas Conserva tion Commission and therefore are not contained herein.

Section 63. Well Construction Not Specifically Covered By This Part; Deviations.

(a) The administrator may grant a deviation from the standards provided the applicant or permittee can supply documentation of reliability, mechanical integrity, design and construction to protect groundwaters of the state in accordance with the water quality standards contained in Chapter VIII, Wyoming Water Quality Rules and Regulations. Such documentation shall include:

(i) Theoretical technology; or

(ii) Full scale operation at another site with similar conditions; or

(iii) A pilot project of scope and length to justify a deviation.

Section 64. Well Location/Siting.

(a) The top of the casing shall terminate above grade or above any known conditions of flooding from runoff or standing water.

The area around the well shall slope away from the well. Surface drainage shall be directed away from the well.

(b) Where a well is to be near a building, the well shall be located at a distance from the building to provide access for repairs, maintenance, etc.

Section 65. Sealing the Annular Space. The annular space shall be sealed to protect it against contamination or pollution by entrance of surface and/or shallow subsurface waters. Annular seals shall be installed to provide protec tion for the casing against corrosion, to assure structural integrity of the casing, and to stabilize the upper forma tion.

(a) Minimum depths of seal below ground surface for various uses of wells will be:

Minimum Type Well	Depth of Seal
Commercial, municipal and industrial waste	30 feet
Special process discharge	30 feet
Artificial recharge and miscellaneous discharge	30 feet
Geothermal wells	30 feet
Observation and monitoring	20 feet
Test wells	30 feet

(b) Sealing conditions. Following are requirements to be observed in sealing the annular space.

(i) Wells situated in unconsolidated, caving material shall have an oversized hole, at least four inches greater in diameter than the production casing, drilled. A conductor casing shall be installed. The space between the conductor casing and the production casing shall be filled with sealing material. The conductor casing may be withdrawn as the sealing material is placed.

(ii) Wells situated in unconsolidated material stratified with significant clay layers shall have an oversized hole of at least four inches greater in diameter than the production casing drilled, with the annular space filled with sealing material. If a clay formation is encountered within five feet of the bottom of the seal, the seal should be extended five feet into the clay formation.

(iii) Wells situated in soft consolidated formations shall have an oversized hole of at least four inches greater in diameter than the production casing. The annular space between the production casing and the drilled hole shall be filled with sealing material.

(iv) Wells situated in "hard" consolidated formations (crystaline or metamorphic rock) shall have an oversized hole drilled with the annular space filled with sealing material.

(c) Sealing material. The sealing material shall consist of neat cement grout, sand-cement grout, bentonite clay or concrete.

(i) Cement used for sealing mixtures shall meet the requirements of ASTM C150 "Standard Specifications for Portland Cement" or API 10B "Recommended Practices for Testing Oil-Well Cements and Cement Additives". Materials used as additives for Portland Cement mixtures in the field shall meet the requirements of ASTM C494 "Standard Specifica tions for Chemical Admixtures for Concrete" or API RP 10B.

(ii) Neat cement shall be composed of one sack of Portland Cement (94 pounds) to 4 1/2 to 6 1/2 gallons of clean water.

(iii) Sand-cement grout shall be composed of not more than two parts by weight of sand and one part of Portland cement to 4 1/2 to 6 1/2 gallons of clean water per sack of cement.

(iv) Concrete used shall be "Class A" or "Class B". Aggregates shall meet the requirements of ASTM C33 "Standard Specifications for Concrete Aggregates".

(v) Special quick-setting cement, retardants to setting, and other additives, including hydrated lime to make the mix more fluid or bentonite to make the mix more fluid and reduce shrinkage, may be used.

(vi) Bentonite clay mixtures shall be composed of bentonite clay and clean water thoroughly mixed before placement so that there are no balls, clods, etc.

(vii) Used drillers mud or cuttings or chips from drilling the borehole shall not be used as sealing material.

(viii) The minimum time that must be allowed for materials containing cement to "set" shall be in accordance with ASTM C150 or API RP10B.

When necessary these times may be reduced by use of accelerators as determined by the well contractor.

(d) Thickness of seal. The thickness of the seal shall be at least two inches and not less than three times the size of the largest coarse aggregate used in the sealing material.

(e) Placement of seal. Before placing the seal, all loose cuttings, chips, or other obstructions shall be removed from the annular space by flushing with water or fluid drilling mud. The sealing material shall be placed when possible, in one continuous operation from the bottom up. The fluid used to force the final sealing material through the casing shall remain under pressure, to prevent back flow, until the sealing material is set.

Section 66. Surface Construction Features.

(a) Openings. Openings into the top of the well which are designed to provide access to the well, i.e., for measuring, chlorinating, adding gravel, etc., shall be protected against entrance of surface waters or foreign matter by installation of water tight caps or plugs. Access openings designed to permit the entrance or egress of air or gas shall terminate above the ground and above known flood levels and shall be protected against the entrance of foreign materials by installation of down turned and screened "U" bends. All other openings (holes, crevices, cracks, etc.) shall be sealed.

A sounding tube, taphole with plug or similar access for the introduction of water level measuring devices may be affixed to the casing of the well as long as the proper seal is maintained. Access ports for water level or pressure measuring devices are required by the State Engineer on all wells greater than four inches diameter.

Section 67. Casing.

(a) The casing shall provide structural stability to prevent casing collapse during installation as well as drillhole wall integrity when installed, be of required size to convey liquid at a specified injection/recovery rate and pressure, and be of required size to allow for sampling.

(i) Steel casing shall meet the following conditions:

(A) Standard and line pipe. This material shall meet one of the following specifications:

(I) API Std. 5L, "Specifications for Line Pipe."

(II) API Std. 5LX, "Specifications for High-Test Line Pipe."

(III) ASTM A53 "Standard Specification for Pipe Steel, Black and Hot Dipped, Zinc-Coated Welded and Seamless."

(IV) ASTM A120 "Standard Specifications for Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses."

(V) ASTM A134 “Standards Specifications for Electric-Fusion (arc) - Welded Steel Plate Pipe (Sizes 16 in. and over).”

(VI) ASTM A135 “Standard Specifications for Electric - Resistance - Welded Steel Pipe.”

(VII) ASTM A139 “Standard Specification for Electric-Fusion (arc) - Welded Steel Pipe (Sizes 4" and over).”

(VIII) ASTM A211 “Standard Specifica tions for Spiral - Welded Steel or Iron Pipe.”

(IX) AWWA C200 “AWWA Standard for Steel Water Pipe 6 inches and Larger.”

(B) Structural steel. This material shall meet one of the following specifications:

(I) ASTM A36 “Standard Specification for Structural Steel.”

(II) ASTM A242 “Standard Specifications for High Strength Low Alloy Structural Steel.”

(III) ASTM A283 “Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars of Structural Quality.”

(IV) ASTM A441 “Tentative Specifications for High-Strength Low Alloy Structural Manganese Vanadium Steel.”

(V) ASTM A570 “Standard Specification for Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality.”

(C) High Strength Carbon steel sheets or “well casing steel.” Each sheet of material shall contain mill markings which will identify the manufacturer and specify that the material is well casing steel which complies with the chemical and physical properties published by the manufacturer.

(D) Stainless Steel casing shall meet the provisions of ASTM A409 “Standard Specification for Welded Large Diameter Austenitic Steel Pipe for Corrosive or High Temperature Service.”

(ii) Plastic can also be used for casing in many locations and under a variety of circumstances. The two groups of plastic materials available are thermoplastics and thermosets.

(A) Thermoplastics. This material shall meet the requirements of ASTM F 480 “Standard Specification for Thermoplastic Water Well Casing Pipe and Couplings made in Standard Dimension Ratios (SDR).”

(B) Thermosets. This material shall meet the requirements of the following specifications.

(I) ASTM D2996 “Standard Specifi cation for Filament Wound Rein-

forced Thermosetting Resin Pipe."

(II) ASTM D2997 "Standard Specification for Centrifugally Cast Reinforced Thermosetting Resin Pipe."

(III) ASTM D3517 "Standard Specification for Reinforced Plastic Mortar Pressure Pipe."

(IV) AWWA C950 "AWWA Standards for Glass - Fiber - Reinforced Thermosetting - Resin Pressure Pipe."

(iii) Concrete pipe used for casing should conform to the following specifications:

(A) ASTM C14 "Standard Specifications for Concrete Sewer, Storm Drain, and Culvert Pipe."

(B) ASTM C76 "Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe."

(C) AWWA C300 "AWWA Standards for Reinforced Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids."

(D) AWWA C301 "AWWA Standards for Prestressed Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids."

(iv) Galvanized sheet metal pipe or natural wood shall not be used as casing.

(b) All casing shall be placed with sufficient care to avoid damage to casing sections and joints. All joints in the casing above the perforations or screens shall be watertight. The uppermost perforations shall be at least below the minimum depth of seal. Casing shall be equipped with centering guides to ensure even thickness of annular seal and/or gravel pack.

(i) Metallic casing. Steel casing may be joined by either welding or by threading and coupling.

(ii) Plastic (non-metallic) casing. Depending on the type of material and its fabrication, plastic casing may be joined by solvent welding or may be mechanically joined. Compatability between potential contaminants and the sealing agent used shall be demonstrated.

Section 68. Sealing/Cementing Off Strata. Where a well penetrates more than one aquifer or water bearing strata, every aquifer and/or strata shall be sealed off to prevent migration of water from one aquifer or strata to another.

(a) Strata shall be sealed off by placing impervious material opposite the strata and opposite the confining formation(s). The seal shall extend above and below the strata no less than ten feet. The sealing material shall fill the annular space in the interval to be sealed, and the surrounding void spaces which might absorb the sealing material. The sealing material shall be placed from the bottom to the

top of the interval to be sealed.

(b) Commercial, municipal and industrial waste and artificial recharge wells shall be sealed/ cemented in order that all aquifers are isolated over the entire length of casing(s) and shall be surrounded by a minimum of two inches of sealant. The sealant/cement plug used to isolate the aquifer(s) shall extend 50 feet above and below the interface between confining layer and the aquifer(s).

(c) Sealing material shall consist of neat cement, cement grout, or bentonite clay as per Section 65(c).

Section 69. Well Construction, Completion, Development and Evaluation.

(a) Developing, redeveloping, or conditioning a well shall be done by methods which will not cause damage to the well or cause adverse subsurface conditions that may destroy barriers to the vertical movement of water between aquifers.

(b) The well opening shall be closed with a cover to prevent the introduction of undesirable material into the well and to insure public safety whenever the well is not in use or when maintenance is being performed on the well.

(c) During well development, every well shall be tested for plumbness and alignment in accordance with AWWA or API approved standards, i.e., deviation checks. The plumbing and alignment tests shall be documented to ensure problems such as key seating, or fatigue failures will not occur.

(d) All injection/recharge wells used for discharge of commercial, municipal or industrial wastes shall inject fluid through a tubing with a packer set immediately above the injection zone or tubing with an approval fluid seal as an alternative.

(e) At a minimum, all commercial, municipal and industrial waste, special process discharge, artificial recharge and miscellaneous discharge wells deviation checks and cement bond logs shall be conducted and documented. The Water Quality Division should be contacted prior to well construction or operation to determine the need for addition al logs and tests.

Section 70. Plugging and Abandonment.

(a) All wells that are no longer useful (including test wells) must be plugged in order to assure that groundwa ter supply is protected and preserved for further use and to eliminate the potential physical hazard. A well is consid ered “abandoned” when it has not been used for a period of one year, unless the owner demonstrates his intention to use the well again by properly maintaining the well in such a way that:

(i) The well has no defects which will allow the impairment of quality of water in the well or in the water bearing formations penetrated.

(ii) The well is covered and the cover is watertight.

(iii) The well is marked so that it can be clearly seen.

(iv) The area surrounding the well is kept clear of brush or debris.

Observation or test wells used in the investigation or management of usable sources of groundwater by state agencies or by engineering or research organizations are not consid ered "abandoned" so long as they are maintained for this purpose. These wells shall be covered with an appropriate cap, and labeled for their particular use.

(b) Preliminary work. Before a well is plugged and abandoned, it shall be investigated by the permittee (owner/ operator) to determine its condition, details of construction and whether there are obstructions that will interfere with the process of filling and sealing.

(c) Filling and sealing. Following are requirements to be observed when plugging wells.

(i) Wells wholly situated in unconsolidated material in an unconfined groundwater zone shall have the uppermost 30 feet sealed with impervious material. The remainder of the well shall be filled with clay, sand, or other suitable inorganic matters as described in paragraph e.

(ii) Wells penetrating several aquifers or formations containing usable water sources shall have the uppermost 30 feet sealed with an impervious material. All screened or perforated intervals shall be sealed to prevent vertical movement of waters from the producing or injected formation. Impervious material shall be placed opposite the confining formation above and below (and including) the screened or perforated interval for a minimum of 50 feet or more.

(iii) Any uncased hole below the well shoe shall be filled with an impervious material as described in paragraph e. to a depth of at least 50 feet above the shoe.

(iv) Whenever production casing has been severed or inadvertently removed the well bore shall be filled with impervious material from a point 50 feet below to a point 50 feet above the point of severance or to the surface limit.

(v) Wells penetrating creviced or fractured rock shall have the portions of the well opposite this formation sealed with neat cement, sand cement grout or concrete. If these formations extend to considerable depth, alternate layers of coarse stone and cement grout or concrete may be used to fill the well.

(vi) Wells in nonfractured, consolidated formations shall have the uppermost 30 feet filled with impervious material and the noncreviced, consolidated formation portion of the well may be filled with clay or other suitable material.

(d) Placement of material. The following requirements shall be observed in placing fill or sealing a plugged or abandoned well.

(i) No material shall be placed in the well unless the administrator has been notified that plugging and abandonment operations are to commence. A minimum of 30 days notice must be given.

(ii) The well shall be filled with the appropriate material as described in paragraph e. from the bottom of the well up.

(iii) Sealing materials shall be placed in the interval or intervals to be sealed by methods that prevent free fall, dilution and/or separation of aggregates from cementing materials.

(iv) When the underground pressure head producing flow is such that a counter-pressure must be applied to force a sealing material into the annular space, this counter-pressure shall be maintained for the length of time required for the cementing mixture to set as specified in Section 65, paragraph (c) (viii) of this part.

(v) To assure that the well is filled and there has been no bridging of the material, verification shall be provided that the volume of material placed in the well installation at least equals the volume of the empty hole.

(e) Material. Requirements for sealing and fill materials are as follows.

(i) Impervious sealing materials. Sealing materials shall have a permeability of 10 - 7 cm/sec or less. Impervious materials include neat cement, sand-cement grout, concrete, and bentonite clay as described in Section 66, paragraph (c). Used drilling muds are not acceptable.

(ii) Filler material. Materials such as clay, silt, sand, gravel, crushed stone, native soil, and mixtures of these materials, as well as those described in the preceeding paragraph may be used as filler material. Material containing organic matter or used drilling muds shall not be used.

(f) Markings. The top of the plug of any plugged and abandoned well shall show clearly, by permanent markings, whether inscribed in the cement or on a steel plate embedded in the cement, the permit number, well identification number and date of plugging.

(g) Reports. Within 15 days after a well has been plugged and abandoned, the owner shall file a plugging record with the Water Quality Division.